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BRANCH OF RESEARCH

MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS

FOREST ECONOMICS

FOREST PRODUCTS

RANGE RESEARCH

JUL

1928



BRANCH OF RESEARCH

July, 1928

CONTENTS

	<u>Page</u>
Foreword.	1
Forest Experiment Stations	
Washington office.	5
Northeastern	6
Central States	7
Lake States.	12
Appalachian.	15
Allegheny.	19
Southern	21
California	24
Pacific Northwest.	30
Northern Rocky Mountain.	34
Southwestern	37
Rocky Mountain	39
Manuscripts.	41
Forest Products	
District 1	43
District 6	45
Forest Economics	
Washington office.	48
Forest Taxation Inquiry.	49
Range Research	
Washington office.	51
District 3	54
Great Basin.	55
Jornada.	59
Santa Rita	60

FOREWORD

INCENTIVES

(From "Introduction to Organic Research," by E. Emmett Reid)
(Continued from May Issue)

Research as a Game. Of all aspects of research perhaps the view of it as a game is the most alluring to the great number who follow it. It has all of the characteristics of a game, and of a good one too. The fascination of baseball is in the infinite variety of situations and the utter impossibility of predicting from one moment to the next what will happen. Chemistry offers an even greater variety of combinations among its seventy odd player-elements, some of which can play any position on the whole diamond, and there is always enough uncertainty as to the results to keep us in suspense.

Games of chance appeal to many. In a sense there is no chance in chemistry as the atoms act according to laws. Dice obey the laws of physics with mathematical exactness. In both cases there are so many factors that we can not know or control, that we can not predict the results. In chemistry there are many long shots, but in some of them the stakes are so high that one chemist after another puts time and money on them.

Others are fond of games of skill, billiards or golf; chemical investigations give scope for the exercise of the utmost dexterity in manipulation as well as the highest skill in construction of apparatus combined with keen discernment in planning.

Much of the zest of a game is in rivalry, and the desire to excel our opponents in the contest. This element is present also in research, as we are ever in competition with other investigators, sometimes in close rivalry, in fact we are always playing a world's series, since our work must stand in comparison with that of the whole civilized world. We must go ahead of what anyone else in the wide, wide world has done in our particular line, or our results are not worth publishing, and when we do publish we present our results to an audience made up of thousands of chemists of all nations and tongues under heaven.

(over)

Competition is particularly keen in the industrial field; the chemists of one rubber company may be regarded as a team playing a series of games with teams from all the other rubber companies. To be sure the scores are not posted at the end of each inning but those interested know who is winning. It is just as thrilling to distance another chemist by manufacturing something at 78 cents per pound which he can not make for less than 80, as it is to go around in 78 to the other fellow's 80. The fact that the company's dividends and the chemist's prospects of promotion depend on the score does not make the game less interesting.

All in all, chemistry is a splendid game, a man's game, into which we can put the best that is in us of strength and of cunning and not seldom of daring. If played properly it is a clean game which trains and elevates, and develops the highest qualities.

What Dr. Whitney says of engineering, he might have said with equal force of chemistry.

No college sport could be put over if it did not contain some of the same elements which make engineering attractive. No one would play the game if it were always a copy or a repetition. If there were no feared defeat nor hoped for victory, no new stresses applied, no new materials discovered and no return but gate receipts, there would be no real amateurs and no sport. When this is applied to engineering proper it meets a perfect analogue. Few good engineers play for the gate receipts; they are led on by a will to accomplish. They seldom reproduce a move or repeat a major operation. They are usually trying some new stunt and are elated or depressed with emphasis because effects are relatively permanent. But the mental tools and processes are just like those of clean-cut sport.

The motives to research may be as varied as are the characters and interests of the men engaged in the pursuit, but the urge which seems the most productive of the highest grade work is that of the fun of the game, the pleasure in the research itself, the love of truth and its pursuit. Ulterior motives of personal profit or even the desire to promote the progress of civilization and the wellbeing of society, all have an element of danger. They are likely to persuade the student, perhaps unconsciously, to control the direction of his search, turning it into so-called profitable channels. But no man can know where lie the great undiscovered truths. Truth itself is a safer guide into the unknown than is any man's guess as to the probable best line of approach to worth-while knowledge. The student who humbly follows where the subject itself seems to lead him, eager to follow whatever turn the investigation naturally takes, is the one most likely to find the richest deposits for his mining. Truth is too manifold, too unexpected, too great, oftentimes too profoundly simple, for any man's successful anticipating. From the most unexpected sources come discoveries that open great vistas far beyond

the previous imagining of any man. The humble following of the subject itself and the suggestions that develop in the research is the method that usually brings the largest results. Interest in the subject itself, the desire to know the truth, the pleasure, the uplift of soul, that comes with the gaining of some new vision into a hitherto unexplored field of reality, these are the safest guides, leading one to results in value far beyond fame or financial profit or some invention that shall increase the perhaps already too great complexity of human life. The instinct for truth, the love of understanding for its own sake is ingrained in the human soul. And to it may safely be made the strongest appeal in inducing students to enter upon the life of research. The fun of the game, the worth of the game for its own sake, makes a keener appeal to men of the finest type than does the thought of possible dollars to accrue or possible fame to be attained.

Those whose minds are on the game receipts make poor players in any game. Those who regard research as a means of self advancement are warned by Professor Williams.

If achievement comes by means of spiritual forces then the animus of research must be spiritualized. . . . Too much have we been stimulated by personal ambition in our "search for truth." Promotion, because of the amount of research we do is not the spiritualization sought for in this plea. The fundamental virtue of the investigator is a passion for truth whatever it be and through whatever channels it may come.

There is a grave danger for the spirit of research when the chief criterion for the advancement of an individual in his position is his ability to turn out voluminous material describing his experiments. This motive prompting the researcher tends more and more to satisfy personal ambition. There will gradually appear a greater amount of polemical writing and controversies over priority of discovery. Nor is this all or the worst of the results attained by such a stimulus to research. Inaccuracies and carelessness in obtaining results are inevitable, it is the logical outcome of a system where bulk and not quality weighs so heavily in seeking promotion.

On the other hand, that land whose cricket and other sports have imbued its citizens with a sense of the "sport for the game's sake" has contributed a succession of epoch-makers in the field of science that makes one wonder whence the inspiration of it all. One can not imagine the immortal Newton worrying very much about the status of his position because the first computation concerning the force of gravity due to the earth at the moon did not yield results as he had anticipated. To him and a great host of his fellow countrymen succeeding him it was sufficient to seek first the kingdom of truth, leaving it to others to judge whether the honors of earth, if they had any value, would be added as a natural result of ability.

There are some who do not care to contribute to charity unless the subscription list is published, or to erect a building for a college unless it bears their names. The published list is forgotten and the building which bears one's name crumbles in time and the donor's name is lost. Not so with our contributions to chemistry. Each new compound or observation when described by the author in a standard journal becomes an integral part of the fabric of chemistry. These journals are distributed to the libraries of institutions and of private individuals all over the known world. The torch of the fanatic fired the library at Alexandria and blotted out much of the accumulated knowledge of that time but a hundred such catastrophes would only make sets of journals harder to obtain. Published work, small or great, good or bad, goes into the record to stay. Wherever a research is started in any field, all that has gone before is reviewed. The surest way to have one's name preserved is to attach it to some discovery in science: one's name thus becomes known not only as long as a certain building stands and to those who pass along a certain street but for all time to all the world. Lest we be unduly puffed up, be it said that our names go in with many thousands of others and there is little likelihood of getting a ton of credit for an ounce of effort.

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FOREST EXPERIMENT STATIONS

Washington

Personnel

Of particular interest are the personnel changes now in the offing. At the present time it appears that both Kempff, of the Northern Rocky Mountain, and Haasis, of the Appalachian, are to be associated with the new Idaho Forest Experiment Station, their resignations from the Forest Service to be effective as of the end of August. Dr. Meyer, of the Central States Station and Dr. Kelley of the Allegheny Station plan to leave us this fall. A number of Research men are planning on taking additional advance work this next school year. These include: Walter Meyer (Yale) McArdle (Michigan), Reineke (Cornell), Sims (Michigan), Sundling (Penn State), Day (Syracuse), Hatch (Yale), Winters (Michigan), and Marshall (Johns Hopkins). Others possibly should be added to this list, but at the time of writing their plans have not yet fully matured.

The Biological Survey has assigned E. E. Horn, formerly of the Tucson field station, to the California Forest Experiment Station to cooperate in the study of wild life problems. The Office of Forest Pathology is assigning to the Southern Forest Experiment Station R. M. Lingren, who has been teaching forest pathology at the University of Minnesota Forest School. Lingren is one of two pathologists provided for in the last appropriation bill for forest pathological work.

During July Eyre left for the Northern Rocky Mountain Forest Experiment Station, where he will be until October. He plans on helping out the Station in all sorts of activities and his services are of particular value in view of the fact that both Kempff and Marshall are leaving the Station this year.

Reineke left in early July for the Central States Station. He will visit the Northeastern in early August. Clements, after spending some time at the Southwestern Station, reported to Washington. Here he became acquainted with the field we are covering in mensuration, and he devoted some time to study and preparation for his new assignment. He left the end of July for the Central States, where he will assist for a month in the growth and yield study; later on he will spend a month at the Allegheny Station.

Library

During the month of July there were 737 books and periodicals loaned from the library, and 83 members of the Service and others consulted the library in person.

The librarian indexed 72 books and periodical articles for the card catalogue last month.

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NORTHEASTERN FOREST EXPERIMENT STATION

Boyce completed his manuscript on the study of Decay in Douglas Fir. He then joined Peirson, Forest Entomologist in the Maine Forest Service, for a trip over the territory in which Peirson is working. During the course of this trip Peirson gave a neat little demonstration of applied forest entomology. The question of the advisability of immediate re-planting of two cut-over pine stands came up. To decide the matter a few white pine transplants had been set out around a stump in each case, and when observed these were badly damaged by the pales weevil, indicating that planting on the areas would be highly inadvisable at present.

Boyce also spent several days with Baldwin and Doctor Romell on the holdings of the Brown Company around Berlin, New Hampshire, and the Rangeley Lakes, Maine. This company has recently set aside a four-thousand acre tract near Berlin to be handled by its forestry department.

Westveld visited the Cherry Mountain experimental area, making a very detailed topographic map of several slash disposal plots. This map will be used later in connection with soil studies to be conducted in cooperation with Professor Morgan of the Connecticut Agricultural Experiment Station.

Temperature records were maintained on seed bed plots, representing various types of seed beds. Highest temperatures were recorded on areas which had been burned over and on clear-cut areas recently cut which contained a deep covering of needle litter.

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CENTRAL STATES FOREST EXPERIMENT STATION

General

When the month opened field work was being actively carried on by four field parties: One in Virginia, two in Illinois and one in Indiana.

McCarthy joined Messrs. Deam and Wilcox for a trip through the northern part of Indiana. These men were engaged in the examination of plantations and woodlots being classified under the tax law of that state. Two days were occupied with Meyer's party in northwestern Indiana. During this time a visit was made to Purdue University to obtain county maps of the state. It was found that these maps are published by the individual county farm bureau agents. These maps, published to record the county farm bureau agents' projects, will serve very well to locate sample plots and areas studied by the Station.

Hanley's party was visited at Havana, Illinois, and several hardwood plots examined in that vicinity were inspected. In this particular region of Illinois much farm land on the east side of the Illinois River had been abandoned and in many places the sand was blowing. An unexpectedly large area of sand land too poor for crops, much of which was blowing, was also found along the Kankakee drainage.

An examination was made of forest lands in Missouri in company with State Forester Dunlap and E. M. Bruner. During this period a large part of the Ozark region was covered as well as the forest lands along the breaks of the Chariton River in north central Missouri. The Ozark region, which extends southward from the Missouri River, is a high plateau largely composed of cherty limestone with a small amount of sandstone and one intrusion of granite, the St. Francis Mountains. The surface limestone is disintegrated, leaving a surface area of broken chert which creates the impression that the soil is thin with the rock close to the surface. Professor Krusekopf of the Soils Department of the University of Missouri assured us, however, that the soil was many feet deep and only shallow where impervious clay hardpans were formed on the flat tops of the plateau. The timber type of such areas was post oak and blackjack oak, but all the breaks of the plateau contained white oak, black oak, red oak, and some hickory with a small amount of other oak species.

The striking characteristic of the Ozark region is the sub-surface drainage which causes the water to break out in large springs at low elevations in the plateau. The forest has been and is still universally burnt. This has resulted almost entirely in a sprout growth. The litter is seldom heavy enough to cause severe fire damage in the form of wounding, and even if allowed to accumulate for a period of years the litter will undoubtedly be lighter than that of the Appalachian hardwood forest. The forest of this region is capable of rapid recovery if protected from fire, since sprouting is so persistent that it is the foremost problem in the cultivation of fields and the clearing of pasture lands. Many clearings for pasturage purposes are abandoned because of inability to conquer the sprouts. With fire protection, seedling reproduction promises to follow quickly. The southeast side of the Ozark region in Missouri shows some variation from that on top of the plateau, due to the occurrence of short-leaf pine and some other species not found to the westward. Only a comparatively small area in southeastern Missouri at low elevation is occupied by a swamp type of forest in which cypress occurs. In the northern part of the state an impervious clay which cannot be drained by tile was found, especially along the Grand River. Here many acres of bottomland upon which drainage has been attempted have been abandoned for farm purposes, and because they are heavily burdened by drainage taxes are in a bad financial situation.

Woodland Grazing

The party conducting the reconnaissance study of woodland grazing spent the first eight days of July in northern Illinois, principally in Ogle and Whiteside counties. Four sample plot studies in connection with this project were measured.

Sample plot work has progressed much more slowly since this party has transferred its activities from Illinois to Indiana. It is more difficult to find suitable areas for sample plot study in this state than had been anticipated. Large areas of some of the counties surveyed were covered without finding a single woods which was not so greatly disturbed by cutting as to be worthless for study in connection with the grazing project. This is partly due to the fact that many Indiana woodlots represent badly wrecked remnants of a virgin beech-maple-yellow poplar forest, whereas many Illinois woodlots were approximately even-aged sprout forests of oak and hickory, developed after clear cutting in pioneer days.

Plantations

During the month, Kellogg and Gordon canvassed Indiana for plantations from Warrick county in the southern edge of the state, westward to Mt. Vernon, northward to Lake Michigan and then eastward in the northern counties. Virtually the western half of the state was covered. The age of the references to plantations renders many of them unreliable, and has caused considerable fruitless travel. However, some of the most interesting and valuable plots have come from such plantings.

The Use of Planting Stock from Southern Nurseries. Twenty to forty years ago, nurseries were not always located near those who wanted to plant trees, and frequently a nearby nurseryman could not supply the species which the land owner wanted to plant. It very frequently occurred, therefore, that stock was used which came from some neighboring state and from an entirely different climatic and geographical area from that in which the trees were set out. Almost without exception, this procedure has met with serious consequences, and where the trees have persisted they usually are of inferior quality.

Walnut. Many land owners in Indiana have met with disappointment in the planting of black walnut. Sometimes it has come as a result of poor judgment in the choice of this species for planting on poor sites and from ignorance of the requirements of black walnut. More often it has come through lack of guidance in thinning the stand at the proper times. Stock has been run in the plantations almost invariably. Usually the farmer has let the stand run its own course, cutting out those trees which die and which are about to do so, leaving the balance to stagnate. One finds many plantings--on good soil--which originally supported splendid timber, where in 35 to 50 years the average dominant stand is about 5-9 inches in diameter. Increment cores taken at stump height usually show fine wide rings for 10-20 years followed by rapidly narrowing ones until the last ones are almost indistinguishable. It appears that walnut must be thinned early, frequently, and heavily, giving each tree ample room for a full, sizeable crown development.

Comparative Growth on the Same Site. An ambitious and enthusiastic farm owner found himself in possession of a place where the soil was so gravelly and sandy and of such topography that crops were not a success. And so he planted it to trees. He used catalpa, black cherry, and green and red ash. These species were planted on the higher, rougher portions where the driest conditions prevailed. Each species was kept by itself.

It appears that there were some odds and ends of planting material of each species, and for some reason there were a few tulip seedlings also. In the very northwest corner of the farm on a hilltop, from which the run-off and percolation of rainwater was rapid, these odds and ends were planted.

Stock has ranged through the plantations; drouth has stunted, killed, and deformed parts of them. A less favorable planting site would be hard to find for the species which he used.

About a square chain on this mixed planting is intact on the level top, and gives an interesting comparison of the development which the several species have made in the 23-24 years since they were planted:-

<u>Species</u>	<u>Av. DBH</u> <u>Inches</u>	<u>Av. Ht.</u> <u>Feet</u>	<u>Trees</u> <u>No.</u>	<u>Clear Length</u> <u>Feet</u>
Yellow Poplar	6.4	34.1	13	8
Black Cherry	4.2	30.2	6	6
Catalpa	5.8	26.4	7	6
Green Ash	2.3	19.5	1	2
Sassafras (native)	1.8	15.0	1	8
Aspen (native)	4.6	24.0	2	none

Increment borings showed the tulip as 19-20 years old. Evidence at their bases showed them to have died back repeatedly, probably due to grazing and drouth. This accounts for the four years difference in age between that of the stand planted in 1904-5 and that of the tulip.

In this instance the sprout tulip has surpassed the other species in four years less time, on the same dry, adverse site.

Strip Coal Lands. Early in the month, opportunity came to inspect some of the lands stripped for coal near Boonville, Indiana. Both recent and older strippings were visited. The extremely unfavorable condition for tree growth in which the lands are left, was very pronounced. In one place fruit trees had been set out on an area, but they were stunted, small and scraggly. The difficulty of harvesting a fruit crop or even timber crop on lands of this sort is a very real and serious problem. Of special interest was the vegetation which was invading naturally. Cattails (*Typha*) were found to come in readily and quickly along the margins of the land-locked, rock-bottomed pools and ponds in the deeper ravines. Various annuals came in above the water's edge in a zone of narrow width. Over the major portion of the disheveled dirt and rock heaps, a

sparse cover of Indian hemp, long-bracted plantain, milkweed, and broom sedge (*Andropogon*) was found. This was followed by trumpet vine (*Bigonia radicans*) as almost the only species in the next stage of succession. An occasional cottonwood and willow were seen, which were sometimes above the moister portions of the dirt mounds. A sycamore and a black walnut were also seen on a south facing slope. Over a limited area, sweet clover occupied the ground almost to the exclusion of other species.

None of these species, save, perhaps the sweet clover, is capable of building up the soil or contributing much material for a litter. The presence of a mat of lianes, such as trumpet vine, on the ground, makes the site a very unfavorable one on which to plant trees.

Oak Study

Hanley and Bower procured from the Illinois Natural History Survey a list of one hundred areas where prospective yield plots might be located, and the month was spent inspecting the designated tracts. With the exception of a very few tracts, they did not measure up to the standard required. Those examined from the Sangamon River northwestward and westward were found to be unsuitable because of their uneven-aged, open character. They had been previously cleared for agricultural purposes or for cordwood, and apparently in neither case was the cutting absolutely clean. Although the majority of the trees were found to be even-aged, on each one-quarter acre there would appear two to five trees varying in age by ten to twenty years. In most cases these older individuals had assumed wolf-tree positions in the canopy. Toward the central and southern parts of the state the designated areas were even more inferior.

Invariably, where plots were found in Illinois, they were pure oak. On the dune sand lands of Mercer and Henderson counties, and on the terraces above the Mississippi, pure stands of black oak were found with an abrupt break to the elm, ash, river birch, soft maple and pin oak type of the bottomland. Black and blackjack oaks were the principal species occurring on the dune sands above the Illinois River with white oak, ash and hickory entering as the soil became heavier and more fertile.

Reineke joined the party at Greenville, Illinois, and remained for a period of about ten days. In the vicinity of Lebanon, Missouri, three suitable yield plots were measured in the pure post oak/black jack type common to the plateau-top in that region. With the owner's assent, one of the areas was clear cut and stem measurements were taken on the suitable trees.

Day and Winters continued the examination of charcoaled areas in Virginia for plots containing thirty to seventy per cent of species other than oak. They have covered the section north of Harrisonburg, Virginia, and have secured 27 plots mostly of the younger age classes. It is very difficult to secure plots in the older age classes, as it appears from general observations that the hickory and pines, the most common associate of the oaks in this region, are gradually killed out. The cause for this has not been fully determined but it results in ragged, understocked stands, valueless for the yield study. The presence of dead chestnut in the stands also constitutes a serious problem, since it becomes difficult to judge the stocking of the plot.

In the course of the month the opportunity occurred to gather nearly 100 stem measurements on pitch pine, scrub pine, red maple and Table mountain pine.

#

LAKE STATES FOREST EXPERIMENT STATION

The Station owes an apology to its sister Stations for not keeping them informed of the developments in the Lake States. Although in theory the Station should function whether any of the technical staff are there or not, in actual practice, when the staff is in the field, office work of at least a technical nature must of necessity be neglected.

Moreover, the summer months are months of accumulation of knowledge, the winter months, the months of dissemination of knowledge.

Since early May the Station has had five crews in the field working on nine projects. Some of these projects were of intensive character, as for instance the study of relation of fires to fire weather, which had to be done in the short period of the spring fire hazard.

Merely to enumerate the projects, Bates made a study of the Superior National Forest problems. He located permanent sample plots in release cuttings of plantations made in scrub oak on the Michigan State Forest at Higgins Lake in cooperation with the School of Forestry and Conservation. He also located reliable sources of seed within the region of Norway and Scotch pine.

Mitchell studied the relation of weather and fire hazard in cooperation with the University of Wisconsin, and worked on compilation and analysis of forest fire statistics for Michigan.

Scholz is studying growth in northern hardwoods after partial cutting, also in cooperation with the University of Wisconsin.

Averell completed the permanent sample plots established last fall on the Chippewa National Forest and studied the timber growth on drainage districts in the State of Wisconsin, the latter work in cooperation with the University of Wisconsin.

Kittredge, with the assistance of Gevorkiantz, devoted his energies to the completion of two manuscripts: one, the "Possibilities of Aspen Lands" and second, the "Possibilities of Scrub Oak Lands in Michigan."

These projects are in all stages of development, from first field notes to preparation of the final draft of the report.

The most interesting development is our study of the effect of removal of excess water upon the growth of timber in swamps. This study started three years ago in cooperation with the Bureau of Public Roads and the Engineering Departments of three state universities. It began as a more or less biological study and has now assumed the significance of a major conservation problem, at least in the states of Wisconsin and Minnesota.

Drainage for agricultural purposes in the two states has proven to a large extent an economic failure. In Wisconsin the drainage districts embrace a drained area of nearly 300,000 acres and practically without exception pay no interest on the bonds. In Minnesota, at least two counties, Beltrami and Lake of the Woods, must declare themselves bankrupt, not being able to meet some \$3,000,000 of drainage bonds which come due, unless the State comes to their rescue.

The financial situation of many counties as the result of heavy taxes caused by drainage ditches is a serious problem. Something must be done to meet the bonds and accumulated interest resulting from the drainage enterprise. The drainage engineers of the two states have therefore grasped at our study as a possible solution of the difficulty. If it can be shown that the drained land, although proven an economic failure as far as agriculture goes, have benefited timber growth, could they not be reclaimed by the State for public forests?

Drainage is in disrepute, forestry is popular. If the State could be convinced that these drained lands are suitable for forest purposes, then the State Drainage Engineer would recommend that the State should buy back the drainage bonds, possibly fifty cents on the dollar and after having acquired them, turn them into State Forests. Our study therefore becomes a critical study in so far as it must determine to what extent drainage has actually benefited timber growth and how much of the drainage land is suitable for forest purposes.

The study is critical for the reason that if we misjudge the situation and place too high a value on these drained lands for forest purposes, we would just be helping to obtain the "chestnuts" for the drainage engineers, - possibly at a loss of public confidence in our judgment later on.

On the other hand, some of the drained areas have been actually benefited by the drainage and show a generous growth. If such lands promise the State sound investment for forestry purposes, then we would be missing a chance to perform a public service by our study.

From the studies so far made, it is evident that under certain conditions of swamp contour, depth of peat, state of peat decomposition and the origin of the peat, some swamp forests have shown a remarkable increase in growth, while others hardly responded to the drainage. It is too soon yet to draw definite conclusions as to what particular conditions determine a swamp's fitness for profitable timber growing. These we hope to develop in the course of the study. After these conditions are definitely determined, then the State should undertake a classification of its swamp land, eliminate those which have no future and possibly acquire those which will become a profitable source of pulp wood, telephone poles, etc.

It is evident as far as the study has progressed, that only a portion of the drained area can meet the requirements of profitable timber growing. Such is the economic significance of our swamp study.

The State Drainage Engineers are only too anxious for this study and even the Bureau of Public Roads is offering \$750 for such a study this summer in Minnesota. The Drainage Engineer of Minnesota is offering another \$750 and the Agricultural Engineering Department of the University of Minnesota offers a man and transportation. The Station feels that as far as this cooperation affords a valued opportunity for getting at the facts as outlined in

our working plan, we should not neglect the offer of help. It should be careful, however, in not attempting to apply the facts to the practical problem at hand. This should be the function of the State Drainage Engineer and the Department of Agricultural Engineering. Since our results will be watched rather closely, it places a heavy responsibility upon the Station.

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APPALACHIAN FOREST EXPERIMENT STATION

General

With the arrival of A. D. Follweiler, formerly with the New Jersey State Forest Service, and J. C. Craig, a student in the School of Forestry and Conservation, at the University of Michigan, the force of field assistants was fully recruited.

Two parties were assigned on the methods of cutting study in the hardwood forests; one under Dr. Haasis, to put in permanent sample plots and to remeasure previously established plots at the Asheville and Berea branch stations; the other, under J. H. Buell, to undertake extensive surveys of reproduction on National Forest cutover areas.

A party headed by Dr. Hursh and including I. H. Sims and C. A. Abell, began the study of the effect of fire with special reference to physical structure of forest soils. The work was started at Bent Creek and continued in the Cowee Mountains, near the Nantahala National Forest.

A fourth party, under MacKinney, left to establish permanent plots on the Natural Bridge National Forest for the study of replacement of blight-killed chestnut.

News has been received that Dr. Haasis had accepted appointment, effective September 1, as Associate Professor of Forestry at the University of Idaho and Assistant Forester of the Idaho Forest Experiment Station. The departure of Haasis means the loss of a second member of the original staff of the Station, the first being that caused by the transfer of McCarthy last year. The Station regrets Dr. Haasis' departure but wishes him the best of success.

In Forest Entomology, Mr. A. H. Beal reported at Asheville to assist on forest insect investigations during the remaining part of the season.

The mill scale party, after moving to mills in the vicinity of Waynesville, left this neighborhood in July for the Shenandoah National Forest where they are now at work near Wardensville. Before R. D. Garver left to join his party he and Frothingham visited the Carr Lumber Company's mill at Pisgah Forest and the plant of the Dimension Manufacturing Company at Black Mountain.

Methods of Cutting - Hardwoods (Mc-2)

(a) Permanent sample plots. Haasis' permanent sample plot party was compelled, by delay in the removal of chestnut acid wood, to cease work on a pair of permanent plots on Stony Fork of Hominy Creek, Pisgah National Forest. Work on two half-acre plots near the point of Shutin-Ridge, Bent Creek experimental forest, was started by Haasis, MacKinney, and assistants, and finished during the month by Craig and Bradshaw. Haasis, Bramble, and Moser spent the latter half of the month at Berea, remeasuring the larger trees on the two plots established in Cowbell Hollow in 1923, and making accessions. The latter were augmented by a reduction from the three to the two-inch diameter class as the lower limit.

During the fall of 1927, fire got into Cowbell Hollow plots and killed considerable of the young growth. It occurred while the leaves were falling and is reported to have burned over some places several times, as additional leaves fell and provided more fuel from day to day. Severe damage was quite spotty and there are parts of the plots apparently unaffected by the fire. Following the burn vigorous sprouting has occurred in some places on the plots.

While fire on the College Forest is to be deplored, it was rather fortunate, inasmuch as a fire did occur, that it included some of the established sample plots. On the whole this accident will afford an excellent opportunity of studying the effects of fires on cut-over areas in the hardwood types.

The difficulty experienced in locating many of the tagged trees on the cut-over plots suggests the strong advisability of making a bole location map as routine practice for the permanent sample plots. It seems almost impossible for the men making the reexamination to pick out, expeditiously, the course followed by the men who did the tagging, especially when there has sprung up in the meantime such a dense undergrowth that it is often difficult to see a tree trunk more than 15 or 20 feet distant and sometimes impossible to distinguish the crowns of the large trees from any appreciable distance. Reexaminations of such plots in the autumn after the leaves fall is another possibility worth consideration. The big objection to this is the difficulty of getting field assistants at that time.

(b) Extensive survey of cut-over areas. Buell's party spent the larger part of the month on a twelve-year-old cutting of 6,000 acres along Wayah Creek on the Nantahala National Forest. A change in the technique used last summer was given a thorough and successful trial. Instead of a careful tally at the end of each five-chains of the reproduction on a single milacre (an area ten links square), a tally of all milacres along the chain was made as to the condition of stocking. This tally showed for each milacre (1) whether the milacre was shaded or open to light; (2) for each "free" milacre the species and height of the tallest dominant tree stem, if any; (3) the origin, seedling, or sprout, of this stem; (4) the nature of the shade, (tree or brush); (5) the condition of slash, if any was present. The milacre strip tally was in conjunction with a tally of the trees three inches and over in diameter on a chain-wide strip and a tally of the smaller diameters on a narrower strip. Forty-three half-acre plots were run by the party and the method appeared to work out very well indeed. It remains for the summary of the data to determine finally whether the milacre strip method is the best for use in the study of hardwood reproduction.

The party made analyses of the growth of seedlings and sprouts obtained from designated milacres in the course of this work.

Efforts were made to locate stands of second-growth oak for the oak yield study but were not successful.

Chestnut Replacement (M-3)

Dr. Korstian and A. L. MacKinney spent a few days on the Natural Bridge National Forest, in company with Supervisor Sears, looking over possible locations for sample plots in the chestnut replacement study to be conducted on the Natural Bridge Forest later in the summer. The plots, like those previously established elsewhere, are expected to throw light on the progress of the natural replacement of blight-killed chestnut by other species. In this case, the plots will be installed in stands containing over three-fourths chestnut. MacKinney spent the latter part of the month largely on office work on the chestnut replacement plots at Bent Creek.

Branch Stations

All field parties have been asked to study new areas visited with reference to their suitability for branch stations or working

centers. Special note was made by Korstian of the facilities on the Natural Bridge, and by Frothingham of the opportunities on the Nantahala, near Franklin. On the Natural Bridge, Arnold Valley and the Arcadia working circle offer considerable promise. These areas are being opened up by a Forest Service road across the divide between the two watersheds. When the road is completed ready access may be had from either Greenlee on the north or Buchanan on the west of the Glenwood Ranger District in which the areas are located. The Glenwood District will not only be more accessible to the Lee Highway (hard surfaced across the State from Bristol to Winchester and northward), but contains a greater diversity of forest conditions desired at a working center than the Pedlar District.

On the Nantahala, the territory visited was that along Wayah Creek. A variety of forest types, a 12-year-old cutting of 6,000 acres exhibiting many kinds and degrees of cutting, good living conditions, and rather easy communications appear to justify consideration of this area, some time in the future, for a working center. With a rainfall of more than seventy inches, the growth here should be at a more rapid rate than in the regions of less rainfall, and this should affect competition and the rate of reproduction on cut-over areas.

Physical Structure of Forest Soils in the Southern Appalachian Mountains, With Special Reference to the Effect of Fire (Pf, A-1).

The introductory work on this project was started by Dr. Hursh, Sims, and Abell at Bent Creek and carried from there to the Cowee Mountains, near the Nantahala National Forest. As a basis for field study soil profiles are being observed at regular intervals along definite transects. Pertinent information is recorded on an outline form for the field description of forest soil. This description records topographic position of each station, the underlying geologic formation, the soil development and the nature and condition of the vegetative cover. The forest floor is given particular attention and the soil profile is described in detail. A record is also kept of drainage conditions and erosion. Distribution of fine and large roots is recorded but no attempt has been made as yet to study root distribution in detail. Photographs are made of representative soil profiles, and soil samples are kept for further laboratory tests.

Forest Insect Studies

The first part of the month was spent largely in establishing experimental southern pine beetle plots and treating pine trees

against the developing broods. During the latter half of the month many brood count analyses have been made to determine the effectiveness of the experimental treatments.

On the cooperative project, "The Interrelation of Insects and Blue Stain," carried on by Forest Pathology and Forest Entomology, collections of stain have been taken from as many species of pine bark beetles and bark beetle galleries as could be obtained.

Forest Pathological Studies

R. M. Nelson, assisted by Frank Kaufert spent the month on the blue stain problem. A large number of cultures have been made of stained wood from trees attacked by bark beetles, and a series of inoculation experiments is being conducted in cooperation with J. A. Beal.

Over 300 specimens of decayed wood have been collected by Hedgcock and Chapman from the mill scale study areas. Approximately 50 different species of wood-rotting fungi have been isolated from these specimens. A key to the cultural characters of the heart rots of oak will eventually be made.

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ALLEGHENY FOREST EXPERIMENT STATION

The entire technical staff on the Allegheny National Forest, except Wood and Lloyd, who spent early July at Camp Ockanickon in the completion of the type map and the marking of the boundary of the experimental area. The new office and camp building at Ockanickon has proved to be comfortable and convenient.

The opportunity to work with a Cornell graduate student in soils, Max J. Plice, who is studying under Dr. Lars G. Rommel, has directed the Station's studies to Heart's Content. The 20 acres at Heart's Content represent a close approach to virgin conditions in the northern hardwoods-hemlock-white pine type of northwest Pennsylvania. In part of the area no living trees have ever been cut and in another the stand has been culled only of the pine. The cutting of large trees, even though dead, has undoubtedly disturbed

the original conditions slightly, but apparently there are no pine areas left in the state which are ideal. There are some hemlock-beech forests, which remain as the white man found them, and will not be cut for two or three years; we hope to achieve the preservation of at least a usable portion of them.

Work at Heart's Content, planned with the personal aid of Dr. Rommel, has consisted of the establishment of stakes at 2-chain intervals on parallel lines run the same distance apart, covering about 70 acres. Plice is taking samples of the humus at each of these stakes, for determination of p^H values. He will supplement these by digging a 30-inch pit at certain of the stakes, in order to obtain the p^H values at this depth also; Dr. Rommel believes that acidity at these two depths is the key to the relationship of soil and vegetation in this particular tract. Lutz has worked with Plice in obtaining the samples, and we are lending our field apparatus for electrometric determination of acidity. Lutz is also planning some supplemental work on the soils, using the pits already dug.

The Station is making a 25 per cent strip survey over the tract, on every other row of stakes. A separate tally is kept of each chain of strip, or on each $1/10$ acre, and reproduction is recorded on 10-link wide strips. Eight or ten chains of strip were extended into the adjacent cutting area, before cutting began, so that the effect of cutting on advance reproduction can be studied. Thanks to Dr. Kelley's thorough knowledge of taxonomy the forest descriptions made for every third chain of strip are very much more complete and satisfactory on the lesser vegetation side than such descriptions usually are. Kelley will later supplement them by detailed studies on small areas. To date the distributions of both major and minor vegetation are hard to explain, but the soil observations of Plice and Lutz are counted upon to help. A start has been made on height and age determinations.

The methods-of-cutting study plots on Little Arnot Run have continued to demand much detailed work. A stump and stem map intended eventually for clear cutting was made, and topographic maps of all four plots. The reproduction counts on all plots were finished, and individual tree records of all standing trees.

Areas suitable for extensive surveys have been located and work begun. An area of excellent advance growth of white pine, much of which has survived the cutting, was found adjacent to Heart's Content in cut-over land; the original stand appears to have been very similar to parts of Heart's Content, where, however,

advance growth is practically absent. Another plot has been laid out in a chemical-wood cutting, partly in grazed and partly in ungrazed land. Present reproduction will be third-growth, and will be the result of two clear-cuttings, the first probably followed by fire. The stand is nearly pure hardwoods.

The junior class from Mont Alto, under the guidance of Dr. Hofmann, visited both Little Arnot and Heart's Content; we have also been in contact with the sophomores from Penn State, under Prof. Newins. The wood-using plants on the Forest and nearby are a drawing-card for forest students.

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SOUTHERN FOREST EXPERIMENT STATION

General

Junior Forester F. I. Righter joined the Station and will assist Barrett with the management and fire studies at the Urania branch station. Righter has had a year's experience in sugar cane plantations in Cuba followed by two years of similar work in Hawaii, including considerable research work during his last year there.

A start was made near the end of the month in revising the flood study report. With District Forest Inspector Evans and State Ranger Norman Core, Demmon made a two-day trip into the Tunica hills country in S. E. Louisiana and S. W. Mississippi to observe at first hand the effects of erosion in the Bluff region.

Pessin spent several days at the Starke branch station where he became acquainted with the naval stores work and discussed our experiments with Wyman from the point of view of a plant physiologist. During that time he and Wyman visited the University of Florida at Gainesville.

The Station was very fortunate in obtaining gratis two 1925 Ford coupes by transfer from the Prohibition Department.

Protection, Fire

Wahlenberg, Pessin, and Righter made the first five-year re-measurement of the series of five seasonal burning plots in longleaf at McNeill, Miss. By using a special home-made extension rod the heights of all trees less than 37 feet tall were measured more accurately and rapidly than would have been possible by means of any of the usual instruments. Trees higher than 37 feet were measured with a Klausner hypsometer, so that we now have a complete record of the height of all trees on the plots. All diameters were measured with a tape.

The same party made the annual summer burn on one of the quarter-acre plots. Flames of an average height of about eight inches burned over 85% of the area in two hours time.

At Starke the Raiford plots were visited and it was found that the so-called wet plots in the younger stands had been burned over by a very severe ground fire, which burned out all the soil and humus from around a large number of trees in both plots, causing some of them to fall over. This pair of plots will have to be abandoned.

Measurements

Barrett, with Righter's help, spent most of the month on the longleaf pine accelerated growth study and finally completed the taper alinement charts by means of multiple curve-linear correlation as outlined by Bruce and Reineke. One chart is based on taper before release and one on taper after release. From these charts the form of the bole before and after release can be compared.

Naval Stores

Two new slash and two new longleaf pines, chipped for the first time in July, were included in the daily weighing tests. These trees have two faces, one to be chipped daily and the other weekly. The hottest weather of the season occurred during the last week in July and the yields from the daily weighings reached their maximum.

Forestation

Wakeley spent several days with Prof. Hayes of the Louisiana State University Forest School on the preparation of a bulletin on the plantations of the Great Southern Lumber Company at Bogalusa.

Demmon and Wakeley visited the two nurseries and most of the plantations at Bogalusa in company with Garrison of the Forestry Department of the Great Southern Lumber Company. Many longleaf seedlings were found dying from an insect attack, believed to be cut worm.

Protection, Others

Diseases. At Camp Pinchot Pessin found a number of long-leaf seedlings affected by a fungus. Spores of Septoria were in evidence. He also found brown spot needle disease common high above the ground and extending to the tops of some 40-foot long-leaf trees and a similar disease in the tops of slash pines.

Demmon and Wakeley visited the spraying plots for brown spot control on seedlings, as well as the plots designed for observation of the spread of this disease, on an area burned over last March.

Insects. Wakeley summarized all data on insects collected by the Station since it was founded, and prepared a report on the work to date with tip moth (Rhyaciona frustrana, Comst.) for presentation at the Entomological Congress at Ithaca, New York in August. The tip moth cages at Bogalusa showed the third brood of insects to be emerging in July.

At Starke, samples of leaf litter from a slash pine stand were gathered and the soil insects collected sent to Dr. Tragardh for his examination.

Ecology

Dr. Pessin, considered several leguminous plants that might be planted to enrich the Choctawhatchee soils. It seems inadvisable to try Kudzu vine (Pueraria Thunbergiana) because it climbs over and thoroughly covers trees up to 40 feet in height in one or two seasons, and once started, is very difficult to eradicate. Of the many legumes of which specimens were obtained, Lespedeza sericea, seems to be the most promising. Seeds will be obtained at McNeill for trial sowings at Camp Pinchot.

Pessin helped Gemmer at Camp Pinchot with plantation examinations and root studies of a longleaf seedling from the 1920 crop and an older longleaf pine tree 27 feet high. Where water was not available roots were exposed by digging with a shovel and ice pick. A craetaegus root 30 feet long without branches was found attached to a bush $3\frac{1}{2}$ feet high. Pessin found mycorrhiza on the roots of pine seedlings just below the surface of the soil.

Hardwoods

Lentz and Putnam have been acquiring an intimate knowledge of hardwood stands and mills in Louisiana by the extensive survey method. In the course of this work they have made contacts with many of the leading operators. As a rule the operators know practically nothing of forestry. An exception was discovered in two men, Mr. John Thistlethwaite of Opelousas, La., and Mr. W. D. Brewer at Palmetto, La. On the Thistlethwaite Preserve of 11,000 acres they found apparently the first real attempt to practice forestry in the southern hardwoods. Extensive stands of cow oak or swamp chestnut oak (Quercus prinus) contain fine timber and their two storied arrangement makes it practicable to leave a good basis for a second cut. These men are experimenting with thinnings and the removal of "wolf" trees. The best cow oak stands in the State were found in Mr. Brewer's operations where selective cutting is being practiced without technical assistance.

On July 30 an examination was made of the cypress knee experiment started in 1914 by W. R. Mattoon on the lands of the Jeanette Cypress and Shingle Company on Bell River. Where cypress knees were cut no serious injury was apparent.

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CALIFORNIA FOREST EXPERIMENT STATION

General

The Station had a number of distinguished visitors this month:

Prof. Albrecht Penck, Professor of Geography, University of Berlin.

Prof. W. M. Davis, Professor (Emeritus) of Geology,
Harvard University.

Prof. Richard Russell, Assoc. Prof. of Geography,
West Texas Technological College.

Dr. Tragardh, Chief Entomologist of the Swedish Forest
Experiment Station.

Dr. Rizner, Dean of the College of Agriculture, Nanking
University.

Prof. F. G. Krauss, Dean of the College of Agriculture,
University of Hawaii.

Supervisor John D. Coffman, of the California Forest, has
been temporarily assigned to the National Park Service and is mak-
ing his headquarters at Hilgard Hall, University of California, and
will assist the Park Service in developing fire plans for their
National Parks.

E. E. Horn, of the Biological Survey, has been assigned to
the Station and moved into headquarters on July 19.

Dr. Bodman of the Soils Division of the University of Cali-
fornia accompanied Dunning through the Stanislaus, Tahoe, Plumas
and Lassen Forests. He was much interested in the varied forest
soils problems. A number of samples were taken in different types.
It is hoped that some future cooperative soils studies may develop.

Management

July was a busy month for the management parties. Siggins,
Hormay and Wright completed reexamination of the eight Mc plots at
Massack on the Plumas. On the same trip a Douglas fir second growth
yield plot was remeasured for the first time on the Tahoe.

A new Mc plot in sugar pine-white fir was laid out on the
Stanislaus. The preliminary survey, mapping and tallying, repro-
duction counts and photos being completed in the virgin stand. The
area will be logged late this fall.

Relogging was completed on Plot 3, Stanislaus and the final
check-up will be completed before the end of the month.

Show, Dr. Craighead, Miller, Kotok, Keen, Person and Dunning
spent considerable time on the Modoc where a large sale in the pure
western yellow pine type is being undertaken. The sale covers an
area of over 100,000 acres and contains about a billion feet of
timber. In the last few years losses from bark beetles have been
steadily increasing and have already depleted the stand up to 10
per cent. In a few isolated places, losses in three years have

amounted to over 35 per cent. In order to curb these enormous losses a very complete and intensive method of cutting will be initiated. The contract provides that the company will take out all insect-invested trees covering 15,000 acres the first year and 30,000 acres thereafter. Following this control cutting, logging will proceed at the rate of 15,000 acres a year until the epidemic has been checked. The object of the visit to this area was to determine the experimental work that should be undertaken by the Bureau of Entomology and the Station. Tentatively, it has been determined to undertake a series of studies using different methods of marking in an effort to eliminate insect susceptible trees. For this purpose large plots will be necessary. Three degrees of cutting will be tried from very heavy to reasonably light over large plots of 500 to 600 acres. Within each one of these larger plots a standard 40 acre sample plot will be established. The Bureau of Entomology will use in addition a number of other plots to follow insect losses during the course of the epidemic. An isolated control area will be selected to note the course of the epidemic without any cultural interference. It is proposed also to set aside within the sale area about 1500 acres for later experimental work. It is evident that the area in general has suffered from severe overgrazing and this phase will require some study.

Planting

Siggins and Hormay examined plantations made early this spring on the Plumas and Stanislaus. Indications are that there will be a high percentage of survival.

Cover Type Map

Typing in the North Coast Ranges was started July 2, Wieslander working two weeks assisting Clar in breaking in two new field assistants. An area in Sonoma, Mendocino and Lake Counties is being mapped using Army Tactical Maps as a base. Work will progress slower than in the Sierra Region because of lower quality base maps, more variability in types and greater inaccessibility. Striking examples of site deterioration due to a combination of tree girdling, burning, and overgrazing are present everywhere. The sought for grass cover is secured by girdling Douglas fir and hardwood trees but in a comparatively few years the soil is lost exposing rock and gravels supporting only brush species.

Wieslander spent a week in Humboldt County enlisting the cooperation of the Humboldt Redwood Reforestation Association and the Indian Service. In connection with a survey of timber ownerships

for tax assessment purposes, Mr. Schofield, forester of the Association, will secure type data in accordance with our classification and Mr. Allan, forester on the Hoopa Indian Reservation, will make a type map of the area under his jurisdiction.

Southern California

With our southern activities concentrated primarily on forest influences studies the active field season comes during the winter months. Consequently Kraebel and Lowdermilk have spent July at headquarters working up last year's data and preparing for next winter's rains. Kraebel completed the contour map and capacity computations of Barranca reservoir, which was found to have a maximum capacity of 55,938 cubic feet (1.28 acre-feet). The greatest amount of water in the reservoir at one time last winter was 11,449 cubic feet on February 4 when the depth gage registered 5.5 feet. This maximum was reached exactly 24 hours after the beginning of the 30-hour storm of which it represents the partial run-off, and occurred after 2.75 inches of rain had fallen on the 47-acre watershed. Percolation into the reservoir floor represents additional run-off for which a ratio will be computed. The somewhat involved computation of total run-off through the silt-clogged weir basin is being done by Engineers of the Santa Ana Watershed Survey.

In response to their chairman's invitation, Kraebel presented to a joint meeting in Riverside of the Tri-counties Reforestation Committee and Conservation Association a statement of the Station's southern program and budget. The meeting voted approval and took action to secure the necessary appropriation from Riverside, Orange and San Bernardino Counties. Kraebel then went to Ontario to study the methods and progress of the Santa Ana Watershed Survey being conducted by Major Wm. Post of the State Engineer's office in cooperation with county and federal authorities.

At Berkeley some preliminary work was done by Dr. Copeland and Kraebel on the study of transpiration in an effort to check the cobalt-chloride paper method with other quantitative methods.

Water Cycle Studies. The experiment designed to isolate the factors influencing surficial run-off and erosion as well as the water cycle of seepage and evaporation, which was begun in March of this year, has been continued by Lowdermilk through July. Approximately 150 inches of artificial rain have been applied to the 8 soil tanks in 70 runs of ten series. The fall of rain is measured with 9 rain gages. The surficial run-off and seepage

are measured, totaled and deducted from total fall of rain to determine evaporation. Erosion is also measured quantitatively. Rain has been applied at the rates of 1.00 to 1.5 inches per hour for durations from 15 minutes up to 8 hours, in series of 10 runs. Natural rain has been treated as a separate series. The contrasted condition of forest soil with its forest litter (a) in place and (b) burned off is being given severe tests. The forest litter continues to function in a remarkable way to facilitate absorption of rain by the soil. The capacity of the litter itself to absorb rain water appears to be insignificant in comparison with its function to keep the percolating water clear and to prevent the clogging of the pores and seepage channels of the soil.

Among the many visitors who have observed the experiment in operation, it is especially desired to mention Professor Doctor Albrecht Penck, the noted Austrian Geographer whose monumental work on the relation of rainfall of the basin of the Elbe, to run-off and evaporation still stands as the most thorough piece of work of this kind; and W. M. Davis, Professor Emeritus of Geography of Harvard University, who is America's foremost authority on Physiography. The persistent and striking influence of forest litter on surficial run-off and erosion appeared to surprise these scientists as it has engineers. Opportunity has been taken to discuss with Professors Penck and Davis problems of the water cycle and criteria of erosion-al norms.

Forest Products

Blue stain study. The report summarizing the most essential data of the Fungimors experiments was completed by Brundage but must await the finishing of a large photostat order before copies may be assembled for mailing to the cooperator and other interested parties.

After a winter season of extra severe climatic conditions favorable to the growth of stain fungi, the results are indeed promising. Whether the officials of the cooperating company will go ahead with the installation of dipping apparatus before the next staining season begins or whether they prefer to conduct further experiments to clear up some of the questions not definitely answered by the first tests will not be known until they have had a chance to study the report very carefully. Marked reduction of stain in all dipped lumber was conclusively demonstrated but the time necessary for immersion in the solution is a very important matter which was left more or less "in the air." Apparently there is not enough difference between the results of 1/2 minute and 5 minute dipping to warrant the extra cost entailed by the longer period. A solution

of higher concentration may be a better preventive with instantaneous immersion than the proportions of chemical to water recommended by the manufacturer with several minutes of soaking. There are several other variables which need further study under more intensive control.

Merchantability of knotty top logs. A purchase of Government stumpage complained about the Forest Service requirements relative to utilization of excessively knotty logs, holding that they were largely unmerchantable, costly to trim and delay producers at the head-saw. The Chief of Forest Management, the Logging Engineer and others connected with timber sales agreed to put on a mill scale study which would determine at least the merchantability phase of the problem. Accordingly the operator segregated in the pond a collection of 100 logs each showing a prize assortment of knots and limb stubs which were subjected to the analytical dissection of a regulation mill scale study. The Office of Products was represented by Brundage who acted as tallyman. Computations are now being made in the Logging Engineer's office. As they are not yet completed definite results cannot be reported at this time but there was so little No. 5 common recorded we are safe in saying that the positive merchantability of the logs, from the standpoint of grades produced, cannot be questioned. A very appreciable per cent of shop grades was sawed from the pines and there was also a small proportion of selects. No. 3 and No. 4 common constituted the bulk of the cut.

Entomology

The first part of the month was spent installing cups on 100 mature western yellow pine and making complete records of the morphological characters of each tree. These trees were selected from four different areas which showed a wide variation in the amount of western pine beetle infestation. The purpose of this study is to determine whether or not there are different strains or varieties of western yellow pine which vary in their degree of susceptibility to attack by the western pine beetle.

Between July 10 and 20 most of Person's time was spent with Dr. Craighead, Miller and Keen, of the Bureau of Entomology and Show and Kotok of the Forest Service. A number of areas were examined and plans for future work on the Modoc National Forest were discussed. Considerable time was spent outlining the plan of procedure for the proposed cutting of the Badger Unit by the Pickering Lumber Company in an attempt to control the severe western pine beetle epidemic and salvage some of the recently killed timber.

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Dr. Ivar Tragardh, Forest Entomologist of Sweden, also favored us with a visit during this period. He had a number of valuable suggestions to make on our studies and we all found his visit extremely profitable and enjoyable.

During the latter part of the month the western pine beetle attraction studies were started. A large screen cage 8'x12'x8' high has been built for testing different substances and needles, bark, phloem and other substances from western yellow pine are being distilled.

A new type of sheet metal cage has been developed for facilitating the study of the abundance of D. brevicornis and all the associated insects found in infested trees.

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PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Marsh's Visit

The visit of Mr. R. E. Marsh, which covered nearly all of July, was the outstanding event of the month. He had about two weeks in Portland, and with Munger made short trips to visit the principal current field activities of the Station, - seeing McArdle on the fog belt slash disposal study in the Grays Harbor region, Meyer and Westveld in central Oregon, the former on the pine yield study and the latter on methods of cutting and of slash disposal, and at Wind River the fire studies activities of Simson and a little of the intensive work being done on Douglas fir germination and survival. A morning was also spent with Dean Peavy on the O.A.C. Forest School Forest near Corvallis, where the cooperative projects in Douglas fir thinnings, tests of western yellow pine regional races, and the Clarke-McNary State Nursery were viewed.

Marsh and Munger attended a meeting of the Oregon State Board of Forestry in Salem, July 30, called primarily to meet with Professor Fairchild and discuss the Forest Taxation Inquiry. The State Forester is on the verge of starting to make a timber inventory and forest type map of the entire State and it seemed advisable to acquaint the Board at this time with the provision of the Mcweeney-McNary bill for a national timber inventory. Accordingly Munger explained this matter to them and the Board decided to defer its project for the present in the expectation that the national project can be started in Oregon before long. The Board formally endorsed the national project and promised its fullest cooperation.

Forest Taxation Inquiry

The Forest Taxation Inquiry commenced its work in the Pacific Northwest the middle of the month and are occupying two rooms in the Station suite which have been allocated for their exclusive use during the summer months when most of the Station's own force is in the field.

Yellow Pine Growth and Yield Study

The western yellow pine growth and yield study crew of three has been in central Oregon the entire month. Meyer himself was in Portland for a few days putting the finishing touches on his manuscript dealing with the application of normal Douglas fir yield tables to actual stands. This crew has spent the greater part of its time studying areas, by a sort of combination plot and single-tree method, which were cut over selectively a number of years ago.

Several of the western Stations have sent in comments on Meyer's working plan for this study which are highly valued. Most of them approve our plan of work and make incidental suggestions only as to details, several of which are already being put into effect.

Normal Yield Tables for Douglas Fir

Dr. Schenck has prepared in German a digest of McArdle's recent Douglas fir yield table article in The West Coast Lumberman for the "Allgemeiner Forst und Jagdzeitung," and transposed the tables to cubic meters and hectars.

Factors Controlling Natural Reproduction of Douglas Fir

Isaac spent the early part of the month in the office revamping the working plan for the intensive reproduction study after it had been thoroughly tested in the field. As a means of interesting operators in the reforestation status of their logged-off lands, letters were prepared for the cooperators upon whose cut-over lands semi-permanent reproduction plots have been established, summarizing the findings on the individual tracts. During the middle of the month a trip was made to the Santiam and Cascade Forests checking up seed tree survival plots and reproduction plots. On the Cascade the Forest Officer on the Western Timber Co. sale was assisted in establishing a new seed tree survival plot. Isaac returned to the intensive reproduction study plots on Wind River for the critical weather period

during the fourth week of July. Recorded air temperatures of 110° F produced surface soil temperatures as high as 166° on dark burned surfaces. This is the highest surface soil temperature we have recorded here. The cambium on the tender stems of young seedlings was cooked at the soil surface and the seedlings toppled over. Many of the older seedlings (in exposed places) with hardened stems were dried out and withered while there was still plenty of soil moisture about their roots to support seedling life under normal weather conditions.

Making the Wind River Nursery and Arboretum Blister Rust Proof

A ten-man crew from the office of Blister Rust Control was at Wind River from June 17 to July 23 conducting an experimental job of Ribes eradication. Certain species were pulled for a distance of one mile from the Nursery, others at a lesser radius. Some scouting for rust was also done all over the neighborhood but none found.

Responses of Fuels to Changes in Atmospheric Humidity

During an unusually hot spell at Wind River, hourly moisture content determinations were made of 21 common forest fuels (by weighing) for 75 consecutive hours. The relative humidity record was also checked hourly. The purpose of the experiment was to get some measure of the degree and rate of change in moisture content of the fuels with changes in relative humidity. It is planned to start another series immediately after a summer rain in order to learn how rapidly drying takes place.

The Cooperative Study of Lightning Hazard referred to in last month's report will after all commence this year, and Professors McMillan and Starr of the Oregon State Engineering Experiment Station O.A.C. are now at work in the worst lightning zones of the state. The project is being financed by the Oregon Forest Fire Association, the District Forester, the State Forester, the Forest Experiment Station, and the Oregon Agri. College.

Slash Disposal Problems and Fire Behavior in Grays Harbor Co.

McArdle spent almost the entire month in Grays Harbor county, Washington, laying out plots for the Douglas fir slash disposal study and securing data for special report on slash disposal and relative fire hazards of various cover types in that region. This report is intended for the cooperative study referred to in last month's report

which is directed by the Western Forestry and Conservation Association and is now under way in Grays Harbor county. With J. L. Alexander, who is to study "fog-belt" silviculture and forestation problems, he visited much of the county to discuss on the ground the different aspects of the slash disposal problem as they are related to silviculture. Two days were spent with Pathologist H. G. Lachmund to give him our slant on the relation of decay to slash disposal in Douglas fir. Lachmund is to cooperate on the slash disposal project.

On Friday, the 13th, three large fires started in slashings in Grays Harbor county and McArdle with his assistant report that they almost "came apart" trying to cover all these fires and some valuable data were obtained on going fires. McArdle spent a day with Robert Polson, one of the principal loggers of the Pacific Northwest, going over a large part of his company's logged-off land. Some time also was spent discussing the fire-behavior and slash disposal studies with State Forester Joy and district wardens Wedekind and Wallace. Toward the end of the month McArdle went to the Hood Canal region where four slash disposal plots were established on the gravel soils peculiar to that region. On his way back to Portland he spent one day on the Long-Bell slash fire at Ryderwood. The rest of the month was put in on computational work at the Portland office.

Western Yellow Pine Methods of Cutting

Westveld completed the mapping and tallying of a 50-acre extensive methods of cutting plot on the Crater Forest. The plot represents current Forest Service cutting practice. Record was made of the cone crop on all of the permanent western yellow pine plots which gives a record on some 6000 trees. The cone crop is light but general throughout the region.

The Regional Races of Western Yellow Pine plantations on the Deschutes and Whitman Forests were examined and found to be in very good condition. The Deschutes plot shows a survival of approximately 90 per cent for all the groups. The Whitman plot is not as good, perhaps because of being planted three weeks later, some groups showing only 50 per cent survival while others are as good as the Deschutes area.

Western Yellow Pine Mill Scale Study

Westveld made a detailed description of the 800 trees on the Shevlin-Hixon mill scale study area while they are standing. As soon as they are felled and bucked a further measurement and description of the trees will be made as the second step in the Station's part of this project.

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NORTHERN ROCKY MOUNTAIN FOREST EXPERIMENT STATION

July 1928, has gone down in meteorological history with the establishment of new temperature maxima at many stations in the Inland Empire. On the 26th Spokane reported a maximum of 108° F., the highest previous mark being 104.4 on August 8, 1898. While Spokane was setting this new record Riparia registered 117°, Lewiston 113°, Walla Walla 111°, and Moscow 105. At the Priest River branch station the highest was only 100.4, which has been exceeded in the past. The 5 p.m. relative humidity was 9% at Spokane on the 26th, which made the high temperature less dangerous to people, but rather critical for forest fires according to the humidities. No large fires were reported, however.

So far this season District I has maintained an excellent record in fire protection. Lightning storms have been numerous but the June and early July rains also were frequent, and the densely timbered areas are still in a condition of low to medium inflammability, whereas in 1925 and 1926 high and extreme inflammability were the rule.

Because of these conditions there have been as yet very few Class C fires, and none large enough to permit reaching them with a special crew to study fire behavior. The season is not over, however, and it may be possible to install one or two fire-behavior sample plots before snow flies.

In the meantime, Gisborne has visited the Pend Oreille, Selway and Coeur d'Alene Forests to explain the new fire-research information available; to help them improve the field use of weather forecasts; and to obtain from them their ideas on fire research, past, present and future. Eight lookouts on the Kaniksu also have been checked in their reporting of lighting storms, and coached in an attempt to obtain better reports. Tests of the inflammability of slash in relation to moisture content are now under way.

Weidman is giving practically his full time in a determined effort to complete his public requirements report on yellow pine in the Northwest. He was able, however, to visit the Coeur d'Alene Forest in company with Supervisor McHarg, and Koch and Wolff of the District Office, to inspect a possible location for a new experimental center on Steamboat Creek on the Coeur d'Alene. Several other prospective areas on this Forest are still to be visited before a decision can be made. The Steamboat area comprises about 2,000 acres, with a stand of about 36 million feet, of which about 50% is white pine. The age class is chiefly 100 to 120 years.

Weidman also had a recent opportunity to see blister rust infection on both Ribes and white pine, near Newman Lake about 25 miles northeast of Spokane. This experience demonstrated the recognized fact that a person must see the actual fruiting stages on the green Ribes leaves, and also the various stages of canker development on pines in order to identify the disease most readily. Observation of dried-out and mounted specimens do not prepare a man adequately to do that.

F. H. Eyre, of the Washington Office, arrived at the Priest River branch station to assist in our field work for two or three months. This detail will be highly beneficial to our Station both from the new viewpoint which Eyre will bring to our work, and because extra help is imperative if our field work is to be completed on the new schedule demanded by Marshall's and Kempff's departures about September 1. An additional field assistant is also being employed beginning early in August.

A satisfactory man has not yet been located to take Kempff's place, but a strenuous effort is being made by Weidman to select a man with the proper qualifications, and to have him on the job so that Kempff can train him for at least two weeks.

Haig returned from his work at Yale and left immediately for northern Idaho to commence a study of old cut-over areas. One day was spent with Marshall in the field to discuss the methods of estimating and recording ground cover, light, and other conditions, to standardize these observations.

The spring examination of 247 screened and 255 open reproduction quadrats was completed in mid-July by Marshall and three field assistants. Less than 10 per cent winter mortality was encountered, larch showing the highest death rate. In new germination an interesting comparison was apparent between the screened and open quadrats. On the former all new germination must have come from dispersal in 1926 or earlier, since the quadrats were covered with screened frames prior to the time of cone opening in 1927. On the unscreened quadrats the light 1927 seed crop was of course available for germination. The number of 1928 seedlings of each species found per acre is shown below.

<u>Species</u>	<u>Unscreened Quadrats</u>	<u>Screened Quadrats</u>
White pine	1,296	1,036
Western larch	101	0
Western hemlock	43	0
Red cedar	65	144
Seed source	1927 and earlier	1926 and earlier

From the germination under the screened quadrats white pine was the only seed which held over for more than a year to any appreciable extent. Apparently stored seed was far more important with this species following the light 1927 seed crop and the heavy 1926 one than the fresh dispersal. If, as seems reasonable to assume with so many quadrats, the amount of stored seed was approximately the same on screened and unscreened quadrats, then there were about 1,050 stored seeds per acre as opposed to only 250 newly shed seeds. This one year holdover in white pine is precisely what one would anticipate with this species, since even under the more favorable germination conditions of the nursery it is a serious problem to get white pine to germinate the first year. The real test of the stored seed theory will come next year, when any holdover seed will have passed the normal period of dormancy.

As mentioned in last month's report, the screened frames have withstood the winter's breakage very satisfactorily; only 10 out of 247 were found to have been destroyed. Of these fatalities seven were caused directly by snow pressure, two by animals walking across the screens, and one by the skidding of a log through the frame.

Marshall, Eyre, and Waters set out seed traps in undisturbed 75 and 300-year age classes. It is planned to keep these traps in place for 50 to 100 years. By counting the catch and by running germination tests of the seed collected in the traps each year we should be able to determine the effect of advancing age on seed production, the nature of seed cycles and the effect of climate, if any, on seed production. Furthermore, these traps should furnish a start on the important problem of obtaining a definite quantitative measure of the abundance of seed produced each year, in contrast to the present method of classifying seed years ocularly as good, fair, or poor.

One of the thinning check plots is being used as a site for seed traps in the younger age class, but in the virgin timber a new 0.8-acre plot was established. In this plot all trees over 0.6-inch D.B.H. were tagged, measured, and described in detail. This should furnish us very interesting inductive information on the development of the white pine type from overmaturity to the climax condition, a subject on which we know nothing except through crude deduction. At present there are 536 trees per acre over 0.6-inch D.B.H. on this plot, including 18 white pines ranging from 24 to 43 inches.

It was observed that a large number of 1927 white fir seedlings were being attacked by some fungus. Waters has traced this to *Pucciniastrum pustulatum*, a rust which finds its alternate host on fireweed.

Kempff completed the marking and surveying for the establishment of seven methods-of-cutting plots in the over-mature timber near the head of Benton Creek, on the experimental forest. The stand here is typical of much of the over-mature northerly slope forest in this region, containing from 1 to 18 veteran white pines per acre. The purpose is to determine both the reproduction obtainable under different methods of cutting, and the growth of the residual stand, when one can be retained.

The seven areas to be cut by different methods vary in size from 2.6 to 7.7 acres, making a total of 35 acres in one block which will be handled as a timber sale yielding about 800 to 1000 cedar poles and piling, and 700,000 board feet of sawlogs.

Three of the areas will be clear cut, the slash being broadcast burned on two and piled and burned on the third. One broadcast burned area will have a plentiful marginal source of white pine seed, and the other practically none. The third area will have a scattered marginal source of seed.

Four areas will be partially cut and the brush piled and burned. The differences will be in the amount and character of the residual stand, and in the supply of white pine seed available. On one area there is a plentiful supply of white pine which will be retained as a shelterwood to be removed after reproduction is established.

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SOUTHWESTERN FOREST EXPERIMENT STATION

The summer rains on the Coconino and generally in Arizona have been exceedingly scanty and of uneven distribution. In very few localities has moisture been sufficient to stimulate growth of shallow rooted herbs. Up to the end of July no pine seedlings of 1928 germination had been observed. Thus it begins to look as if the heavy western yellow pine seed crop of 1927 were all in vain.

Krauch and Lexen have completed an examination of all the experimental plantations in the vicinity of Flagstaff.

An examination has recently been made of some 80 western yellow pine seedlings and saplings subjected to damage by grazing more or less continuously since 1914. There is a striking relation between initial height of trees and subsequent recovery, the greatest recovery being in the tallest individuals. This is readily explained on the theory that a relatively large seedling has more reserve and is less affected by the removal of a few shoots than is a small seedling. The records include no seedlings below about five years old, for the good reason that such tender age were to be found when the records began. Investigations on the 1919 stand of seedlings showed that very few of those bitten off while under three years of age ever recovered, whereas of those which escaped serious injury until about five years of age a good proportion have progressed satisfactorily despite occasional subsequent injury.

The spotted character of natural reproduction in all forest types of the Southwest has suggested important local variations in soil. It is not uncommon to find one spot bare of seedlings while another spot a few feet distant is densely stocked. Again seedlings of the same age in different spots may vary in height from six inches to six feet. In some instances the unequal distribution or development can be accounted for by such factors as shade, root competition, depth and gross physical characteristics of the soil, or topography; but in other instances no external differences are apparent, and through the process of elimination the evidence points to inconspicuous soil variations such as chemical composition or organic content. In order to obtain further clues, soils from spots showing different conditions of reproduction have been potted and planted to young seedlings. It is assumed that if the seedlings under identical environment develop unequally and in conformity with the relation exhibited on the natural sites, the soil theory will have been materially strengthened. The logical course then is to follow up with tests to determine the nature of the soil differences.

An experiment has recently been undertaken with the object of obtaining additional information on two problems pertaining to natural reproduction of western yellow pine. One is the activity of rodents in eating seeds and girdling or cutting of seedlings. The other is the competition of grasses with young seedlings. Previous investigations have shown that mice, chipmunks and mantle ground squirrels consume large quantities of pine seed and that it is well within the range of possibility for these animals to appropriate practically an entire seed crop. It has also been found that mice and porcupines gnaw the bark of seedlings and that other rodents, probably rats and squirrels, cut them down completely. Dense bunch grasses, particularly *Festuca arizonica* shade out young seedlings or rob them of moisture. General observations indicate that mice do more damage in dense, tall grass than where the grass has been grazed by livestock.

In order to obtain a further check and demonstration of the influence of the above factors, two series of plots were established in a uniformly dense stand of *Festuca arizonica*. One series was enclosed with rodent proof fencing, while the other is protected only against domestic livestock. Each series consists of the following plots: Two controls, one denuded by uprooting the grasses, one burned, and three clipped to heights of 2, 6 and 10 inches respectively. Each plot is 1 x 3 meters in size. All have been mapped in detail. Although a bountiful seed crop fell in this locality in the fall of 1927, 600 pine seeds were scattered over each plot at the beginning of the summer rainy season. At the end of July, however, the rains have been too scanty to promote germination. If germination is inadequate this year to obtain at least 100 seedlings on each plot the seeding will be repeated about July 1 each year until a satisfactory stand of seedlings is obtained. Periodic examinations will then be made in order to determine survival on the various plots.

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ROCKY MOUNTAIN EXPERIMENT STATION

Roeser put in practically all of his time at the Fremont Station, the principal job being the marking and measuring of another plot in the demonstration forest which is to be cut over this fall. At the same time considerable progress was made in thinning one of the plots marked last fall and in cleaning up another plot. Two plots cut over in 1923 near the head of Numpa Gulch were remeasured, and it appears that growth for the five-year period in these two Douglas fir combined thinning and cutting plots was appreciably greater in the one more heavily cut.

At the beginning of the month the somewhat delayed observations on Western yellow pine flower production were made on the .6 acre area set aside for the purpose. This year's flower crop is not large, but the percentage of flowers which have set appears to be higher than usual. While this species is known as a periodic seed producer, with one year of very high production offset by three or four years in which little or no seed is produced, local observations to date indicate that quite a large number of flowers are borne annually, but that the percentage of these which is fertilized and eventually develops into cones is small..

The weather during the month behaved very freakishly. An extended drought including practically all of the first decade was followed by fifteen days of extremely wet weather, which was abruptly terminated on the 25th, when another comparatively dry spell set in. On the 17th a fall of 1.52" was recorded, and on the following day 1.38" of rain was precipitated in about forty minutes. The remarkable feature of this rain was that 1.01" fell in the first thirteen minutes, the fastest fall during this brief period being at the rate of 5.28" per hour. Not only were roads and trails eroded to the extent that they needed immediate repair, but sand and gravel were washed from open spots on grazed slopes with grades as low as 25% to the extent that deposits 4" to 6" deep were made where the moving material was stopped by vegetation. Messrs. Chapline, of Washington, Forsling, of the Great Basin Experiment Station, and Dr. W. P. Taylor, U. S. Biological Survey, Tucson, Arizona, visited the Station on the 19th, and studied erosion damage resulting from the storm. Mr. Chapline also took several pictures of typical examples of erosion.

Two progress reports, "Pitch Girdle Damage in Sapling Douglas Fir Stands on the Pike National Forest" and "Thinning in Jack Pine Plantations on the Nebraska National Forest," were submitted during the month.

August Activities

An inspection will be made of mistletoe activity on four plots recently added to Block A of the demonstration forest, for the purpose of marking the stand to eliminate diseased trees as much as possible. The stand on this area is a selection stand with a generous age-class representation, but it is known to be more heavily infected than any other stand of western yellow pine in the vicinity of the Fremont Station. To eliminate the mistletoe will probably necessitate a clear-cutting, which is not desirable. The problem is interesting.

Two trips will be made by Roeser between the 13th and the end of the month. The three cutting plots in Engelmann spruce, near Spruce Lodge on the Arapaho Forest, will first be visited and remeasured. These plots were established in 1922, and no remeasurements have since been attempted. Following this work, the western yellow pine thinning plots near Pagosa Springs on the San Juan Forest will, likewise, be remeasured. Such time as is left following his return to Fremont will probably be spent in making reproduction counts on the fourteen scattered quadrats in the cut-over area in Numpa Gulch, and in helping Williamson with necessary improvement work.

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Manuscripts

Some Relations of Temperature and Length of Germination Period to the Percentage of Germination of Seeds, Especially of Pitch Pine and Rice. F. W. Haasis. (Dissertation submitted to the Board of University Studies, Johns Hopkins University, in conformity with the requirements for the degree of Doctor of Philosophy).

A program of branch stations and centers of work for the Pacific Northwest Forest Experiment Station. T. T. Munger.

Occurrence of "Pitch Girdle" in Sapling Douglas Fir Stands on the Pike National Forest. Jacob Roeser, Jr.

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IN PRINT

Barrett, L. I. Fire Damage done to Mature Loblolly Pine stand. (Naval Stores Review, August 4, 1928).

Dunning, Duncan. A Tree Classification for the Selection Forests of the Sierra Nevada. (J.A.R. May 1, 1928).

Hatch, Alden B. Observations on the Influence of Rodents on Immediate Reproduction Following Logging in Northern Idaho. (The Idaho Forester, 10: 25, 1928).

Hursh, C. H. The Reactions of Plant Stems to Fungous Products. (Phytopathology 18: 603-610, July, 1928).

Korstian, C. F. Chestnut Killed by Blight Replaced by Other Valuable Trees. (Yearbook, 1927).

" " Timber from Southern White Cedar Bogs on Coastal Swamp Land. (Yearbook, 1927).

" " Intermountain Brush Lands not Potential Western Yellow Pine Sites. (Forest Worker, May, 1928).

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- Mowat, E. R. Some of the Activities of the U. P. National Forest Experiment Station. (Development Bureau News, August 1, 1928).
- Munger, T. T. Some Forest Problems of the Northwest in June 1928. (Northwest Science, Vol. 2, No. 2).
- Stickel, Paul W. Physical Characteristics and Silvicultural Importance of Podsol Soil. (Ecology, April, 1928).
- Wahlenberg, W. G. Reforestation and Cattle Grazing May be Practiced on the Same Land in the South. (Naval Stores Review, August 4, 1928).

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OFFICE OF FOREST PRODUCTS - District One

First District Stump to Mill Green Chain Study on Individual Western Yellow Pine Trees Made During July

Field work on the first of a series of studies planned to obtain the production costs and value of the products for individual trees of different diameters and heights, from the stump to the mill green chain, was completed during July. The initial study was made in the western yellow pine type of Western Montana in cooperation with the Western Lumber Company of Milltown, Montana.

Through the excellent cooperation of the company, the Forest Service was able to carry on the study in the woods with three men, Bradner and Anderson of the Products Office, and District Logging Engineer Neff. In the sawmill the company cooperated to the extent of furnishing a lumber grader and a board marker to assist Bradner and Anderson in the mill scale end of the study.

An area of approximately 10 acres and containing about 140 M feet b.m. was studied. The exact area logged off in the study and the amount of scale which it contained will be determined in the Office. Data were obtained on trees 14 to 30 inches in D.B.H. Output studies on sawing and caterpillar tractor skidding in tree lengths were made on the timber cut. Cost of bucking the trees on the landing and loading the logs on the car was also obtained. Considerable information was kept on the individual tree studied, i.e., stump height, d.i.b. of stump, d.b.h. of tree, merchantable length, top diameter utilized, loss in breakage and long butts, age of timber and condition. As the trees were bucked up on the landing each log was numbered with the tree number and the log position in the tree. The scale was of course obtained both by tree and by caterpillar loads.

In the mill a green chain tally of the lumber in each log was obtained. Each board was tallied by grade, thickness, width, and length. Sufficient data are available on the time and cost of sawing logs on the headsaw to obtain the sawmill cost by log sizes.

Two other studies of this sort have been arranged for this fall. The first will be carried on in September in cooperation with the A.C.M. Company of Bonner, Montana. The second will be made in October in cooperation with the J. Neils Lumber Company of Libby, Montana. Western yellow pine will be studied in both cases. Logs cut ahead of skidding and crowded conditions in the mill pond had precluded an attempt to carry out the studies during August.

Woods Waste Survey

The field work on this project was continued throughout the month. During the time when Mr. I. V. Anderson was working on the stump to mill green chain study, the tally of waste survey plots was continued by Mr. Homer E. Anderson, an assistant. A large number of plots were taken in the Idaho white pine type on cutting areas of the Clearwater Timber Company, Winton Lumber Company, Potlatch Lumber Company and Ohio Match Company, and in the western yellow pine type on the Craig Mountain Lumber Company's holdings.

Census

While the Idaho-Montana Census was practically completed on June 31, some difficulty was experienced in rounding up four of the operators listed as delinquent at that time. The last schedule was received on July 26 and the canvass of both States has been reported closed.

Wood Preservation

A collection of data covering some of the District One wood preservation projects was compiled and forwarded to District Four. A request had been made for treating schedules, service test records and other information needed in attempting to promote the use of treated lodgepole pine posts in South Idaho.

Lumber Prices

Av. Mill-Run Prices	Annual 1927	Annual 1928	First Q. 1928	April 1928	May 1928	June 1928
Idaho White Pine	\$35.86	\$30.17	\$30.20	\$30.59	\$31.25	\$31.14
Western Yellow Pine	25.17	24.19	26.55	24.22	24.11	23.83
Larch-Fir	18.19	16.38	17.60	17.77	18.11	18.61
White Fir	17.41	16.30	17.89	18.57	17.16	16.71
Spruce	23.39	25.67	24.35	23.70	23.16	18.71

Miscellaneous

Mr. C. Rietz of the Timber Physics Section of the Forest Products Laboratory has been in the District since June 28 on the survey of moisture contents project. During the month of July satisfactory

groups of moisture content samples were collected at the Anaconda Copper Mining Company mill at Bonner, Montana, the Winton Lumber Company mill at Gibbs, Idaho, the Coeur d'Alene Mill Company mill at Coeur d'Alene, Idaho, the Panhandle Lumber Company plant at Spirit Lake, Idaho, and the Potlatch Lumber Company plant at Potlatch, Idaho. Work in this District will be completed with the collection of moisture content samples at the Lewiston, Idaho plant of the Clearwater Timber Company. The species studied includes western white and western yellow pine, western larch, mountain Douglas fir and lowland white fir. The data collected by Mr. Rietz will furnish the information on the moisture contents of lumber as shipped from Inland Empire mills during the summer season. Moisture content samples from the same species and at the same mill, with the exception of the Clearwater Timber Company were obtained for the winter season in March, 1927.

E. M. Davis, Assistant Wood Technologist at the Forest Products Laboratory arrived in the District on July 21, to make some preliminary arrangements for a study of the characteristic defects of various grades of softwood lumber. The work to be done in this District was started at the Blackwell Lumber Company mill, Coeur d'Alene, Idaho, with Mr. G. C. Morbeck of the Laboratory as leader of one crew. A second crew will probably start work at Libby, Montana, about August 7, with Mr. Davis in charge.

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OFFICE OF FOREST PRODUCTS - District Six

Douglas Fir Air-seasoning Study

During the second half of July Johnson took down the four air-seasoning study piles of 1x12"-16' No. 1 and No. 2 Common Douglas fir at Mill B of the Weyerhaeuser Timber Company, Everett, Washington, the Bureau of Grades of the West Coast Lumbermen's Association cooperating by supplying an inspector to grade the stock. The stock, yard-piled for 40 days, had dried to a moisture content of about 13 per cent, as shown by the twenty-four 16-inch samples (six in each pile). This moisture content is considered by the company as about right for these grades and thickness of stock from the standpoint of the trade and minimum of degrade.

As previously stated, the study included two variables; 3-inch versus 4-inch spacing and special 1x4-inch stickers versus

self-sticking. All stock was box-piled. Each pile contained at least 35 whole-board samples. Incompletely worked up data indicates that there was little difference in the drying rate between the piles in which 4-inch spacing between boards in a layer was used and those with 3-inch spacings. In the self-stuck piles better than 40 per cent of the stickers were degraded because of surface checks.

After seasoning all stock was machined S2S and again inspected.

General Survey of Wood Waste in the Logging Camps of the Douglas Fir Region

Mention was made in last month's report of the completion by Hodgson of a tentative draft of the final report. Since that time it has been reviewed largely from the standpoint of the matter included, general organization and form, general findings, and the like.

The matter of publication was discussed with Marsh, who felt that with certain modifications, there would be fair to good chance to print the report as a Government bulletin. Hodgson is now working the report over with the idea that it may be printed by the Government.

In connection with the project it was necessary to secure a large amount of field data, most of which was used, in one form or another, in preparing the report. Some of it, however, could not be used, consisting of what may be considered as by-product material, such as data dealing with snags, trees left and stumps.

Felling and Bucking Study in the Douglas Fir Region

During the month, the working plan for this project was completed.

The plan, in general, proposes two general methods of study; a "Conference Method" and a "Technical Method." The former will include general observations, information and opinions (generally from the fellers and buckers and especially from the supervising heads) which will be an aid in analyzing the technical data and in drawing correct conclusions. The latter method consists of systematic observations and data recorded in connection with the actual performance of felling and bucking. This method will be pursued along two general methods of approach which have been designated in the plans as "Individual Tree Method" and "Unit Area Method."

It is planned to start the field work in the spring of 1929, continuing it through 1930. The field work during 1929, or when the "conference" and "individual tree" methods will be employed, will be done by one man, or the project leader. In 1930, when the "unit area" method is to be used in large part, the project leader and an assistant will be required.

The project may become a cooperative undertaking, but with the bulk of the work done by the Portland Office of Forest Products. In connection with the more or less involved and difficult phases relating to pure mechanics, cooperation from the Forest Products Laboratory will be very helpful in developing technical methods of study.

Logging Phase of Western Yellow Pine Mill Utilization Study

Part of the month was spent by Spelman in developing methods for study of the logging operation of the cooperating company, with a view to determining the relative cost of logging trees of different size and character. It is planned to base the work on time studies, supplementing such studies from data taken from the records of the company.

Red Alder Book Matches

After considerable experimenting the Coast Book Match Company of Tacoma, Washington, has found that red alder, of all local hardwoods, makes the best book match splint (veneer).

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Lumber Census

District 6 finished its canvass during the early part of the month. District 3 had previously completed its work and sent in a news note for local publication. Practically everything is in from the western Districts except a few important reports from California. The Census had not completed its follow-up in the East at the end of the month. Preliminary reports for both lumber and pulpwood are quite badly delayed on account of the slow delivery of final reports and hampering conditions which arise in the odd year due to the large number of projects which have to be handled simultaneously.

Lumber Distribution

The revised questionnaire for 1928 has been submitted to the six western Districts and the Bureau of the Census for criticism. It is also proposed to request criticism from various sources of our revised consumption tables in particular regard to the wide difference existing in per capita consumption between the West and the East. The Department of Commerce has been asked to give whatever evidence is available from their resources tending to corroborate this difference.

Census of 1929

In view of the approach of the decennial census, it has seemed wise to lay track for a few of the most important statistical items concerning which information has been too scarce in the past. An analysis has been made of the questions asked in previous decades concerning the production and consumption of farm-woodlot material on farms. This seems justified on account of the very large and important area of forest soils included within the farms. A tentative questionnaire has been prepared for the 1929 census covering this subject more amply than ever before, and steps have been taken to secure consideration by the Department and the Bureau of the Census in plenty of time for the decennial canvass. Canada gets far more information along this line than the United States. The agricultural schedule is always crowded with crop questions, some of which from the point of view of the forester are far less important than some of the woodlot information we need. Especial need is felt for more reliable data in regard to the production and consumption of fuel wood and fencing which form

very important items in the Drain Table, upon which a great many of our economic ideas are based. These items are produced not only on farms but in timber camps, and in order to get the whole story it will be necessary to ask suitable questions about them, both in the agricultural questionnaire and in the manufactures questionnaire for lumber and timber products.

Logging and Milling Waste

Dr. George Rommel, the special investigator of vegetable waste, asked for estimates based on our waste figures showing logging waste and mill waste both in cords and in tons by regions.

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FOREST TAXATION INQUIRY

Substantial progress has been made in the New Hampshire study, with Murphy, Hammar and Pingree on this project. It has been decided that, since it would be necessary for Hammar and Pingree to leave this work in order to join the force in Oregon early in August, it would probably be necessary to limit the intensive examination of sample areas in New Hampshire to a single town. For this reason, after a careful canvass of the situation, with the assistance of the State Forester and State Tax Commission, the town of London was selected for special study. Local assistance, both clerical and field, was arranged for and a considerable part of the work completed by the end of the month.

Fairchild, Hall and Herbert assembled in Portland about the middle of the month to start the field work in the Pacific Northwest. Very convenient office space was borrowed from the Pacific Northwest Forest Experiment Station, at 514 Lewis Building. The advice and assistance of District Forester Granger and Director Munger have been drawn upon very freely in getting started. R. E. Marsh, of the Washington office, has been in Portland, and has contributed to the formulation of plans.

Fairchild and Hall, together with other members of the Forest Service and a number of important representatives of the lumber industry, attended a meeting of the Oregon State Board of Forestry at Salem on July 30th. Fairchild was given an opportunity to explain the tentative plans of study, which were very favorably received. A long discussion of the details of these proposed questionnaires followed, which was most helpful.

The expectation is to depend, for an important part of the data required for study in the Pacific Northwest, upon the cooperation of lumber and pulp manufacturers and of loggers. It is planned to approach them with questionnaires which were prepared in tentative form. Conferences are being held with representative men to obtain the best advice in perfecting these questionnaires and placing them before the industry.

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RANGE RESEARCH

Washington Office

Mr. Chapline Leaves for the Field

Mr. Chapline left for the field July 14th. His immediate objective was the Alpine Laboratory, Manitou, Colorado.

Mr. Chapline Attends Range Research Methods Conference

Through the courtesy of Dr. F. E. Clements of the Carnegie Institution of Washington a committee was called together at the Alpine Laboratory of that Institution from July 16 to 21 to consider ecological methods and concepts in grazing research. Besides Dr. Clements, representing the Carnegie Institution, and who acted as chairman, the committee consisted of W. R. Chapline, C. L. Forsling of the Great Basin Experiment Station and R. R. Hill in charge of Range Surveys and technical range administration, representing the Forest Service, Dr. Walter P. Taylor, of the U. S. Biological Survey and Dr. A. W. Sampson of the University of California.

The primary objective was to take advantage of the experience and contributions of students who have entered the field of range research from different approaches and to refine and organize these into a body of tested knowledge of the greatest usefulness, especially with a view to securing greater uniformity in methods and concepts. In order to insure a comprehensive and fundamental treatment the fullest regard was had for the entire biotic community, including both plants and animals.

A provisional outline was prepared designed chiefly to call forth a full expression of views on the part of research workers. The three-fold basis of investigation of habitat, including both climate and soil, vegetation, and animals is considered essential.

The outline is divided into three sections in order to emphasize the three chief points of approach, methods and technique, concepts and terms, and general organization. Methods and technique also fall logically into three divisions, viz., the measurement of habitat-factors by means of batteries of instruments, the measurement and record of biotic communities by means of quadrats, transects, maps, etc., and the experimental control of conditions and organisms by exclosures, enclosures, cages, etc. Under general organization was considered cooperation and collaboration, application and practice, teaching, and other features of general interest.

It is hoped the response to the outline developed will make possible a fuller draft which can be made available to all.

Cooperative Tests With Sweetclover, Wheatgrass, and Brome

The conference at the Alpine Laboratory was completed on July 21 and Mr. Chapline met Mr. Kephart of the Bureau of Plant Industry, at Mancos, Colorado. Mr. Chapline writes as follows:

"We visited the plots on the Montezuma Forest and made a trip to the Fort Lewis Agricultural School to see their dry land agriculture forage crop work. It does not appear that a very satisfactory stand of sweetclover was obtained on the Montezuma plots this year, except where brush had been burned. Some older plots seeded several years ago, in cooperation with the Colorado Agricultural Extension Service, showed a thin stand of yellow sweetclover and a number of clumps of smooth brome grass. These seedlings are on a heavily grazed spring range and it is possible that the seedling plants of the sweetclover have been rather heavily grazed. Those, however, which survived the spring grazing have doubtless become well enough established so that they have seeded in their second year. Supervisor Hoffman states, however, that there was a much better stand of sweetclover last year and in 1926 than there is this year.

"At Fort Lewis they are having rather good success with sweetclover, both white and yellow, crested and slender wheatgrass and several other cultivated species under dry land farming conditions. The annual rainfall is about 18 inches, largely in the form of snow, and the elevation about 7600 ft.

"We also visited the Colorado National Forest sweetclover seedlings. The plots established last fall and this spring showed a very thin stand at the present time of small seedlings. Supervisor Kreutzer stated that there appeared to be many more early in the year. The plot is covered with a heavy stand of native vegetation and it is possible that many of these seedlings may have been killed out by the severe competition.

"A series of plots established several years ago on the Colorado Forest showed a few sweetclover plants still remaining, but that area has come under a Forest Service land exchange and a fairway of a golf course cuts right through the center of the experimental plots, practically ruining them for further consideration.

"While at Ft. Collins we took advantage of the opportunity to see the work of the Colorado Agricultural Experiment Station,

both in their grazed pasture experiment and in the seeding of abandoned dry land farm areas, as well as other cultivated farm areas. It appears that in that area sweetclover is successful in 80 per cent or more of the trials when the land is plowed under proper dry land procedure and the sweetclover seed is drilled in.

"The sweetclover cooperative tests were considered with Mr. Hatton and Mr. Douglas, in Denver. Mr. Hatton suggested that we obtain a report from the Supervisors in the district regarding sweetclover plantings on and near the forests. Mr. Kephart plans to make a report of the trip, together with a statement of further suggestions for cooperation and expects to submit this to me about September 1."

Department Exhibit Committee Meets

Dayton attended, with Mr. Robert R. Hill of the Washington office, the meeting of this committee at Dr. Warburton's office August 31st. Mr. Chapline's preliminary outline of an exhibit of the spring range problem at the International Livestock Association's semicentennial at Chicago was tentatively approved.

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FORAGE INVESTIGATIONS

Plant Routine During July

25 specimens, representing 4 collections, were submitted to the Bureau of Plant Industry for formal determination. 138 plants, representing 2 collections, were reported on to the field, and 314 photostatic prints of economic-notes cards were sent out. Approximately 600 plants were added to the herbarium. A new art-metal herbarium case (badly needed) was added to our equipment. 135 plants were mounted.

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District 3

A trip was made to the Clarkdale-Jerome mining district the first week in July. The party personnel were District Forester Pooler, Supervisors Miller and Grubb, Pearson and Cooperrider from research. A rather extensive area on both the Prescott and Coconino Forests was examined - an area that is or might be expected to be affected by smelter gases.

The growth of spring maturing grasses, the only evident increase in vegetative spread of all grasses, where lightly grazed, is striking. Revegetation and growth continue to indicate that grasses are not affected by SO₂ gas. Rapidity of revegetation gives promise of future ground cover even in areas formerly almost completely occupied by shrubs and at present supporting a very sparse grass cover.

The time element, the relative period of time necessary for grasses to occupy the ground once occupied by brush, is the factor governing the future of the watershed. Establishment of balance between soil and cover is necessary to control run-off. The degree of control of run-off will determine whether productive soil is to remain in place normally or be carried away to clog drainage lines and eventually rest in water storage basins.

The establishment and growth of grasses in areas in which shrubs and some weeds have been killed by gas is an excellent example of the result of elimination of competition between the classes of vegetation in a region of low rainfall.

Our time has been largely devoted to the range project in the saw-timber type on the Tusayan Forest. Considerable difficulty has been encountered in handling of stock due to the extreme dryness of the season. What is considered rather unusual distribution of cattle on feed small in moisture content has been secured by systematic salting even though water spacing has been very unsatisfactory.

Some time has been given over to following certain leads holding considerable promise for solving the local reproduction damage problem. That stock graze reproduction in the absence of herbaceous forage has often been claimed to be due to absence of adequate feed. It now seems probable that reproduction damage that under certain conditions does take place in the presence of forage, may be explained. If research along this line proves what now seems to be true, then the reason for excessive damage on the Colorado Plateau can not only be explained but steps can be taken to control a large part of it.

The season has been a very trying one, both from the standpoint of shortage of stock water and development of summer feed. Ground moisture from the abundant early winter snows held up remarkably well. The early development of forage in the bunchgrass type during May and June was probably normal. Deficiency in rainfall and especially effective rainfall since February caused a shortage of stock water and lack of growth of such herbs as normally develop with July rain.

Some water development has been secured on the experimental sheep range. On the cattle range under study a number of temporary waters are now being developed by tanking. We hope to have the water situation on these ranges very much improved, and to be able to relieve the congestion around old permanent waters.

Recent visitors have been: District Forester Pooler, Supervisor Kimball and Range Examiner Morris of the Tusayan Forest, Secretary Eabach of the Arizona Woolgrowers' Association, Dr. Taylor of the Biological Survey, Range Specialist McGinnies of the University of Arizona, and several local stockmen.

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GREAT BASIN EXPERIMENT STATION

General Notes

Work during the month of July was confined to the projects located in the vicinity of the station field headquarters.

The Station force was augmented by the arrival, shortly after July 1, of Assistant Supervisor D. A. Arrivee, of the Targhee N. F. and Forest Ranger Jack Albano of the Wyoming Forest for a month's training detail. They were put through the course of quadrat mapping, major plot listing, plant vigor clipping, utilization study, etc., and a general study of all the station projects and their aims. Several evenings and most of July 24, which is sacred to the Mormons and a holiday in Utah, were spent discussing concepts and principles in range research and management.

Visitors

The Station was favored with a short visit by the Forester, District Forester Rutledge, and Supervisor Humphrey on July 10 and 11.

During the short time available the Forester was shown over representative parts of the Station work and was given a cross-section of the intensive range use in Utah.

Mr. L. W. Kephart, Agronomist, of the Bureau of Plant Industry, made a 3-day visit to become acquainted with the artificial range reseeding work. He was interested in the results with the yellow and white sweetclover and crested wheatgrass seed supplied by his Bureau last year. Of the three, yellow sweetclover has shown up the best to date. It bloomed several weeks earlier than the white variety and may be expected to mature seed. The chief difficulty being confronted at the present time is excessive grazing by jack rabbits. These rodents have practically destroyed the created wheatgrass and have grazed the clovers very closely on all the unprotected areas. It is probable that the Bureau of Plant Industry will be able to cooperate with the station on work with sweetclover and other introduced forage plants in the near future.

Dr. W. P. Taylor of the Biological Survey, from Tuscon, visited the station July 12 to 15 enroute to Colorado Springs. He was shown areas where considerable damage is being done by pocket gophers, rabbits, grey ground-squirrels, and porcupines. Many phases of the rodent and other animal life phases were discussed with him. This conference brought out more than ever what the Station has recognized for some time that the animal life phase should not be overlooked in range research. The field is much larger than mere extermination or attempted extermination of rodents. A knowledge of the habits and life histories is essential for determining the role of these animals in the habitat as well as for developing economical means of control. Some of the rodents, such as pocket gophers may play a beneficial as well as damaging part in the order of things. Practically nothing is known regarding methods of range or forest management to control rodents. The extensive distribution of these animals, often on land of little economical value, may make special methods of control impracticable and more should be known regarding land management as a control measure.

Dr. Cowles, head of the Botany Department of the University of Chicago, eight of his students at the summer school at the Utah Agriculture College, and Dr. Cotton of the Brigham Young University visited the station on July 14 and 15. Dr. Cowles was much interested in seeing the type area where Sampson did his plant succession work as well as other phases of the station work. It is expected that one of his students will return to the station in August to work on a problem for a doctors degree.

Climate

Undoubtedly our colleagues in research, who read the notes from the range stations, are growing tired of the constant reference to climatic conditions but wherever the weather is followed it always provides items of news interest. So pardon us for another. The month of July has broken all records for summer drought since the station was established. June bid fair for a favorable summer with 1.20 inches of rainfall up to the 13th. This is .38 inches in excess of normal for the month. From that date on the precipitation has amounted to only .18 of an inch. This is so little as to be inconsequential. The normal for July is 1.96 inches. To date (August 1) therefore we have had practically 47 days of continuous drought and the vegetation does not look too good.

Niggerhead Study

For the first time since the niggerhead (Rudbeckia) study on Bluebell Flat was started in 1923, this year's records show no gain on the protected area where the increase in grass is offering keen competition to the niggerhead. There was an average gain in the number of plants on the open moderately grazed plot. The location of niggerhead in the successional stages has not yet been worked out satisfactorily. It apparently thrives on overgrazed areas where the soil has not been depleted. Its aggressive character and little value as forage make it a menace in most range types in the aspen zone. The study to date indicates that the native grasses, if given full opportunity, will hold it in check but even under moderate grazing it will continue to increase in amount.

Black Cattle

A bunch of 30 black cattle, mostly pure breed Angus, are being used in the range utilization study pasture this season. It is the first attempt to graze this breed on the high summer range in this vicinity and their use in the utilization study offers the additional opportunity of testing out this breed on the range. In spite of the occurrence of an abundance of tall larkspur in the pasture no cases of poisoning by this plant have occurred to date. In fact the animals show not only an aversion for this weed but are inclined to graze other weeds much less than the naturalized cattle. This is probably due to their being unaccustomed to other than grass and alfalfa forage.

Research Methods Conferences

Forsling spent July 16 to 20 inclusive with Dr. F. E. Clements of the Carnegie Institution, at the Alpine Laboratory on Pikes Peak near Colorado Springs, where a conference was held to discuss range ecological research methods. The aim of the meeting was to make a start toward rounding up the methods used in ecological range research. The outline tentatively drawn up will be mimeographed and sent to all men engaged in range studies for them to add their suggestions after which all of the information will be made available for general reference.

A half a day was spent at Fremont going over the projects there with Roeser. The opportunity to observe the extensive studies of climatic conditions under various conditions was well worth while.

Heavy Rain and Erosion of Granite Soils

The idea is held by some that coarse granite soils are not very subject to erosion from surface runoff because of the readiness with which water is absorbed through the open structure. Two storms which occurred on the east slope of Pikes Peak on July 17 and 18 indicated very clearly that such soils will erode if the conditions are favorable. (They do everywhere else! Editor). Incidentally the storm on the 18th was one of unusual intensity. The tipping bucket gauge at the Fremont Station recorded 1.01 inches of rain in 13 minutes. The fall was at the rate of 6 inches per hour during the minute of heaviest rainfall and a fall at the rate of 4.80 inches per hour occurred for eight minutes. The total precipitation was probably greater than 1.01 inches in 13 minutes since the hail which melted subsequently to the rainstorm added .35 inch of moisture. The most intensive fall of the storm on the 17th was at the rate of 1.80 inches per hour, a total of .99 inches of rain and .15 inch of water in the form of hail falling during two hours and 47 minutes.

Both of these storms caused erosion on the coarse granite soils characteristic of the region, although a far greater amount of soil was moved by the one on the 18th. There is no doubt that such soil will absorb much more water in a relatively short time than the fine textured clay soils. However, when the downpour is at a more rapid rate than the water can be absorbed very rapid erosion occurs. The granite soil particles lack the cohesiveness of particles of clay soils and heavy movement takes place wherever there is no vegetation to stop it. Forsling estimates that the amount of soil moved, per cent of area within the path of the storm, on

Pikes Peak where plant cover and topographic conditions are similar to those on the erosion study areas at the Great Basin Station far exceeded that ever moved by any storm on the latter areas. The Great Basin erosion areas have a heavy clay soil.

The effect of a grass cover in checking erosion on the Pikes Peak area was very evident. In one place where the range was overgrazed on a slope below a fence numerous gullies started at the fence and were cut all the way down to a draw bottom although there were no gullies on the non-overgrazed area above the fence. In another place where the overgrazing occurred above a fence the numerous gullies that originated there were stopped at or just below the fence by the dense grass cover, and the heavy load of gravel and sand being carried in the gullies was all deposited within 25 to 30 feet below the fence.

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JORNADA RANGE RESERVE

Range Conditions and Precipitation

The dry period since May 13, finally ended on July 19 for the Jornada and fairly general rains covered most adjacent ranges during the same week. Records available to date from 4 stations show a variation of 0.50" to 1.30" rainfall for July. The growing season is well under way, and additional rains during August should produce a satisfactory summer forage crop.

Condition of Stock

The entire breeding herd came through the dry spring in good shape. Figures for the grazing year 1928 show the remarkably low loss of 1.1 per cent. This was made possible by the sale of 65 cull cows and all the old T-hook bulls last autumn. Calves are making satisfactory gains, and should have plenty of weight by fall delivery. An offer of 11¢ has been received already for the fall delivery of Jornada calves.

Equipment

Bids for a new half-ton truck were opened on July 1, and the Ford proposal was accepted on July 5. Delivery was made on July 24, just 19 days later. Judgment as to the quality of the new Ford is being suspended until a year's service has been obtained.

Three fire extinguishers, one quart capacity, were ordered for the office building and dwelling house at headquarters.

Investigative Work

Utilization, carrying capacity, forage crop, and all handling stock project reports for the grazing year 1928 were completed. Additional work on the plant collections was accomplished.

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SANTA RITA RANGE RESERVE

Carrying Capacity

Much of the past month has been devoted to checking up on utilization of the pastures and quadrats as well as checking the numbers of stock in some of the Reserve pastures. Despite the extended dry period this spring conditions were found to be surprisingly good and a considerable amount of surplus forage was found in a number of the pastures. Shortage of water during June made it necessary to make some adjustments in the pastures; however, less than fifty head were moved all told and during July the pastures were again put back on the basis provided for in the pasture management plan.

Handling Stock

Cattle have continued in good to excellent condition with the poorer ones picking up rapidly as a result of improved range conditions locally over the Reserve. All the calves on the Reserve have been contracted for fall delivery at \$40.00 per head. Incidentally these are calves too, that will average 7 to 8 months of age. We would hate to venture a guess on the ages of some of the reported calf sales that have been made at different points in the District.

Natural Revegetation

A small strip of range embracing the foothill type has made excellent growth as a result of local rains about the middle of July.

At Florida Station 4.24 inches of rainfall was recorded during the month. In the mesa and desert types no growth at all has occurred and conditions are drier than for a number of years past. This late in the summer, however, a good general rain fell on the last day of July and it is expected that growth will respond rapidly all over the Reserve within the next few days. In the mesa type of pasture 18 an examination of the range indicated a large amount of surplus feed, most of which was black grama that, despite the drouth conditions, has remained green up to 4 or 4 inches above the ground. Rothrock grama on this same area has all been blown down and is lying flat on the ground and now represents a total loss so far as forage value is concerned. Everywhere on the Reserve this species has suffered the same fate during the past spring as a direct result of continued high winds. Ordinarily there is a noticeable loss from windfall and trampling but not to compare with what appears to be about a 40 to 50 per cent loss this year. Deferred use in the rothrock grama type would, apparently, yield little in the way of forage for spring use.

The installation of a new water tank capable of holding 16,000 gallons of water (if you have the water) was completed during the month and will, we hope, serve to tide us over future dry periods. Just now its chief purpose is ornamental since our well is practically dry and no relief in sight until a lot more rain falls.

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